Chapter 12

Potential Impacts and Assessment of Take

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12 POTENTIAL IMPACTS AND ASSESSMENT OF TAKE

12.1 Introduction

Chapter 12 addresses 2 of the basic requirements of an HCP/NCCP, namely that

1. Landowners show what adverse impacts to covered species might result with implementation of their HCP/NCCP.
2. Landowners assess the *take*, i.e., the number of animals or plants that might be adversely impacted.

The Environmental Impact Study/Program Timberland Environmental Impact Report (EIS/PTEIR), prepared for the wildlife agencies with the assistance of Stillwater Sciences, will address a broader array of potential impacts by examining various alternatives to our HCP/NCCP, as required under NEPA and CEQA.

12.1.1 Covered activities

MRC recognizes that our covered activities, taken in total, will have a greater effect on ecosystems in the plan area than a single PTHP. However, our conservation measures, while targeted toward covered species and their habitat, indirectly benefit the ecosystems of which these species are a part. By protecting and recruiting wildlife trees, for example, we provide habitat for cavity nesters, as well as for bats that build maternity colonies in basal hollows. Protections for salmonids and their aquatic habitat produce benefits for aquatic insects and amphibians, even apart from the red-legged frogs and coastal tailed frogs covered by our HCP/NCCP.

The management goal of our HCP/NCCP is to grow and conserve a functional redwood forest that sustains native ecosystems. In some cases, a covered activity may alter occupied habitat and result in harm or death to an individual of a species. Such results, though possible, should be uncommon because (1) conservation measures limit certain activities (e.g., by setting up buffer areas) and (2) some species are rarely in harvest areas where impacts are likely (e.g., coastal tailed frogs do not move more than a few meters from streams).

Finally, in assessing the impact of our HCP/NCCP, we have compared our proposed conservation measures and monitoring programs to our current operational practices, driven by 3 key documents:

1. MRC Management Plan (2010).
2. California Forest Practice Rules (CDF 2010).
3. FSC-US Forest Management Standard (v1.0, 2010).

12.2 Effects of MRC Covered Activities

12.2.1 Assessment of effects

Assessing the effects of MRC covered activities is difficult because of the widespread and diverse forests that make up the plan area. Several factors come into play:[1]

- Large number of potentially affected resources.
- Numerous ways by which covered activities can affect resources.
- Synergy which produces an effect greater than the sum of individual effects.
- Difficulty of defining recovery rates.
- Uncertainty about spatial and temporal scales for assessment.
- Unpredictability of future events (both management and natural events).

[1] Reid 1993, MacDonald 2000, Dunne et al. 2001

- Impact of land use beyond property boundaries.

12.2.2 Watershed analysis

There are recognized shortcomings in the various methods for identifying, predicting, or avoiding significant cumulative effects at the watershed level (Beschta et al. 1995, Berg et al. 1996, Reid 1998a, MacDonald 2000, Dunne et al. 2001). A report by the Science Review Panel, co-sponsored by the California State Resources Agency and NMFS, recommended watershed analysis as the best tool for (1) evaluating existing and potential cumulative effects, and (2) identifying methods to avoid, minimize, or mitigate adverse cumulative effects on anadromous salmonid and their habitat (Ligon et al. 1999).

Watershed analysis, conducted as part of our HCP/NCCP,

- Assists in reducing non-point source pollution.
- Evaluates current and past land management practices relevant to aquatic habitat and aquatic species.
- Establishes a baseline for monitoring watershed conditions over time.

This analysis helps MRC management to develop conservation measures which reduce impacts to aquatic resources as well as restore or improve aquatic habitat.

12.2.3 PTHP requirements

Programmatic Timber Harvest Plans (PTHPs) provide project-specific or site-specific assessments of the impact of covered activities as detailed in the California Forest Practice Rules (CFPR). However, there are issues that MRC must consider in a larger context than a single PTHP, namely

- Peak flow.
- Landslide risk.
- Sediment transport.
- Status of stream reaches and habitat conditions.
- Road systems.
- Rates of harvest over time.

This chapter assesses the effects of MRC covered activities at the planning watershed scale and at the regional scale as well.

In the future, each MRC PTHP will reference information and assessment from our HCP/NCCP and the wildlife agencies' EIS/PTEIR. For example, when addressing impacts to aquatic habitat, a PTHP will incorporate (1) the findings of watershed analysis regarding past and current problem areas and sensitive resources, (2) HCP/NCCP conservation measures, and (3) the assessment of potential impacts and take contained in our HCP/NCCP.

12.2.4 Spatial and temporal scales

The scales of analysis vary by the problem at hand. For fish, the spatial scale may be a watershed or sub-watershed. For wildlife, the spatial scale may cut across several watersheds.

The cumulative effects assessment of our HCP/NCCP focuses on landscape-level effects at several spatial scales:

- Planning watersheds.
- Watershed analysis units (WAU).
- River basins.

- Inventory blocks.
- Region of Mendocino County.

Planning watersheds are the basic spatial unit in the assessment of fish and aquatic resources. Such watersheds may be too small, however, for some types of assessment. In those cases, planning watersheds may be aggregated into larger units, such as WAUs. WAUs may also be aggregated into inventory blocks or river basins to provide a broader, more regional context for assessment.

The time scales in the assessment generally focus on the first 40 years of our HCP/NCCP and the expected duration of the ITP (80 years). Assessment of current and past impacts incorporates similar time scales, with some discussions focused on the past 10 years, others on the past 20 or 50, and still others focused on the first wave of logging activity over 100 years ago. Likewise, MRC will use projections about future timber harvests to predict future resource trends under HCP/NCCP implementation.

12.2.5 Land uses and actions considered

12.2.5.1 MRC neighbors

The lands surrounding or adjacent to the plan area are state-owned commercial timberland and parks, as well as privately-owned forests.

Jackson Demonstration State Forest (JDSF) is 50,200 ac (20,315 ha) managed by the state of California for purposes of forestry research (CDF 2001). JDSF has created a plan for managing its forest that includes timber harvest and recreation.

State parks adjacent to or near the plan area include Lower Big River, Navarro Redwoods, Hendy Woods, and Montgomery Woods. No commercial timber management occurs in these state parks.

In addition to MRC, there are 6 privately-owned forests in Mendocino County that are over 2500 ac:

1. Hawthorne Timber Co., LLC (The Campbell Group).
2. Coastal Ridges, LLC.
3. Soper-Wheeler Co.
4. Gualala Redwoods, Inc.
5. Redwood Forest Foundation, Inc. (Usal Redwood Forest).
6. Conservation Fund / The Nature Conservancy.

12.2.5.2 WAUs within the plan area

The plan area is located across 12 WAUs that cover approximately 532,045 ac (215,311 ha). It comprises about 40% of the total WAU acreage. The amount of acreage that MRC owns within a WAU varies. In the Elk Creek watershed, MRC owns the largest slice—78%. In the Upper Russian River watershed, MRC owns only about 14% of the land. For 5 of the 12 WAUs, MRC owns between 53-78% of the land.

Table 12-1 WAUs in Plan Area

WAUs in Plan Area		
WAU	**WAU Acres**	**% Plan Area**
Albion River	50,828	29%
Alder Creek/Schooner	57,762	22%
Big River	75,261	44%
Cottaneva Creek	10,569	75%
Elk Creek	18,059	78%
Garcia River	68,292	19%
Greenwood Creek	16,440	58%
Hollow Tree Creek	44,443	46%
Navarro River	103,084	53%
Noyo River	43,990	44%
Rockport Coastal Streams	17,255	59%
Upper Russian River	26,062	14%

12.2.5.3 TMDL

The plan area is within several watersheds that have undergone development of Total Maximum Daily Loads (TMDL) by the Environmental Protection Agency (EPA) under the authority of the Clean Water Act. A TMDL identifies all sediment sources and recommends corrective action for problems. Watersheds that have TMDL allocations within the plan area are

- Albion River.
- Eel River (South Fork).
- Gualala River.
- Navarro River.
- Noyo River.
- Big River.
- Russian River.
- Garcia River.

After the EPA completes a TMDL, the state is responsible for producing an action plan to implement the recommendations in the TMDL. Currently, only Garcia River has an action plan. Landowners in the Garcia River basin have 3 options:

1. Comply with the waste discharge prohibitions.
2. Comply with an approved Erosion Control Plan and approved site-specific management plan.
3. Comply with an approved Erosion Control Plan and the Garcia River Management Plan.

The wastewater discharge prohibitions include controllable discharge of soil, silt, bark, slash, sawdust, or other organic and earthen material from any logging, construction, gravel mining, agriculture, grazing or other activity into waters of the State within the Garcia River watershed. For the foreseeable future and until there are implemented action plans for all the watersheds within the plan area, negative impacts from lands outside MRC property may continue to adversely affect aquatic resources within the plan area.

12.2.6 Cumulative effects in the plan area

12.2.6.1 Past, present, and future

Most of the plan area was clear-cut from the mid-to-late 1800s and well into the 1900s. Logging usually was conducted watershed by watershed. After all or most trees were removed, operations moved on to the next watershed. During first-cycle logging, technology and management practices were not as developed as in later years. Removal of old-growth redwoods and Douglas fir resulted in increased ground and stream disturbances. Logs were transported down river via splash-dams or dragged into and across streams. These early practices required repeated burning to reduce slash (Sawyer et al. 2000a, p. 27). Frequent burns favor Douglas-fir and redwoods. Stands that underwent these early harvest practices are even-aged, very dense stands. As technology improved, harvest practices concentrated on removing the highest merchantable timber.

California passed its first Forest Practices Act (FPA) in 1945. The FPA required 25-49 seed trees per ac (10-20 seed trees per ha) to remain following timber harvest (Sawyer et al. 2000a). Most companies aerially seeded Douglas-fir and left 25-49 redwoods/ac (10-20 redwoods/ha). After 20 years, this resulted in dense Douglas-fir stands—2023 to 4047 trees/ac (5100 to 10,000 trees/ha)—with few or no redwoods (Sawyer et al. 2000a). The practice of aerial seeding was not a frequent occurrence in the plan area.

As second-growth harvesting started, there was clear-cutting with and without planting; this included limited post-harvest vegetation management. Selective regeneration harvests (selection, group selection, or transition) and intensive even-aged management, along with post-harvest vegetation management to restore hardwood dominated stands, started approximately 10 years ago. The proportion of uneven-aged regeneration has grown ever since and will continue to grow; even-aged management will likely be phased out in the plan area.

MRC employs either uneven-aged silviculture or silviculture necessary to phase timber stands into uneven-aged structure, such as variable retention. Currently, MRC applies variable retention only to poorly stocked, tanoak-dominated stands, keeping 10-40% or more of the original stand in rolling and permanent pockets of untouched trees. This method allows MRC to plant conifer trees in the openings created by harvest and quickly restore tanoak-dominated stands back to conifer-dominated stands. Since December 1999, MRC has planted over 7 million redwood and Douglas-fir seedlings (Table 12-2).

Overall, MRC harvests timber at a current rate of less than 2% of our inventory per year; this will double our inventory in 50 years. MRC proposes within the PTEIR that conifer harvest levels will not exceed Long-Term Sustainable Yield (LTSY) in any decade. Moreover, we are evaluating and adjusting management practices, such as use of herbicides, to decrease negative impacts on the environment.

In addition to adopting more sustainable harvest practices, MRC will continue to sell conservation easements, such as the 87-acre parcel near Comptche in the Albion watershed.

Reforestation Process

1. A forester snips a sprout from a redwood stump and sends it to a lab.

2. A lab technician takes shavings from the sprout and grows redwood cultivars in a petri dish.

3. Cultivars are placed in styrofoam containers to continue growth at a nursery.

4. Yearling redwood trees at the nursery are sent to MRC.

5. Some of the yearling redwoods (100 per cultivar) are planted at the Navarro Hedge Farm which is a repository for each MRC cultivar.

6. Forestry crews plant most of the yearling redwoods in harvested stands to optimize spacing of new growth.

7. Cycle begins again: sprouting from a redwood stump becomes a source for new cultivar material or, in most cases, natural reforestation.

Table 12-2 Tree Planting

MRC Tree Planting	
Year	**Trees Planted**
1999	610,670
2000	619,000
2001	740,826
2002	707,538
2003	625,012
2004	541,995
2005	609,845
2006	782,830
2007	665,515
2008	769,007
2009	487,430
2010	360,780
2011	288,084*
Total	**7,808,532**

TABLE NOTE
***Planting for Jan/Feb 2011 only**

In the future and for the life of our HCP/NCCP, MRC plans to further develop and improve our sustainable forest practices to decrease impacts and to enhance aquatic and terrestrial wildlife and habitat. Some of these practices include

- Commercial thinning.
- High retention selection.
- Single-tree selection.
- Group selection.
- Variable retention.
- Transition.

12.2.6.2 Impact of timber industry on fisheries

CDFG initiated the Sports Fish Restoration Program (funded by Dingle-Johnson legislation) in the 1950s to facilitate rehabilitation of many fisheries impacted by timber, land use, and water use practices. One of the objectives of the program was to restore access to anadromous fish streams that were blocked by accumulations of woody debris from logging operations.

The enormity of the LWD problem caused by logging practices in the timber boom of the 1940s and 1950s led to a focus on LWD removal. This emphasis on LWD removal was not without merit. Maps and tables contained in proposal documents describe 51 migration barriers out of 835 logjams which totaled an estimated 336,791 ft^3 (9,537 m^3) of woody debris. For example, on Hayworth Creek in the headwaters of the Noyo River, biologists documented the presence of 17 logjams over a 2-mile reach. Of these, 10 were considered to be upstream passage barriers up to 15 ft (4.6 m) high. One of the largest jams was estimated to be 100 ft (30.5 m) long x 100 ft (30.5 m) wide x 8 ft (2.4 m) high, containing approximately 40,000 ft^3 (1,133 m^3) of wood.

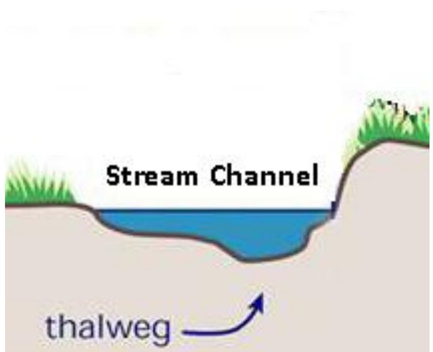
Inmate crews of CAL FIRE carried out much of the LWD removal work. They cleared significant portions of the streams of all debris that could accumulate to form a migration barrier

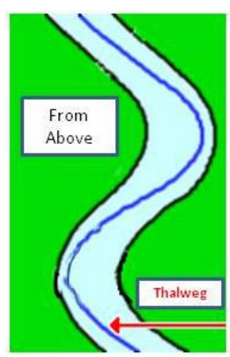
Surveying for the thalweg—a line defining the deepest points of a stream

or act as a sediment trap. From 1959-1969, there were 5 proposals for LWD clearance projects in Mendocino County. The proposals documented the miles of streams that were accessible to anadromous fish and the miles that would be accessible upon clearance completion. In many instances, the proposals presented the "extremes" for viable anadromous fish spawning and rearing habitat upstream. Typically, fisheries biologists would walk the streams, noting the location and size of debris jams on topographic maps. The proposals included traced copies of many of these maps. Proponents calculated the required effort for clearance by classifying the streams and estimating the number of stream miles needing clearance. Often, they noted the level of scattered debris between major logjams so that their estimates could be adjusted accordingly.

Subsequent floods in these areas cleared away woody debris and removed large accumulations of fine sediment. With stream channels damaged by timber harvest and stream structure altered by log removal, floods scoured the channel and lowered the thalweg elevation in some stream sections by as much as 10-20 ft (3-6 m).

As a result of stream clearance projects, the importance of LWD for the maintenance of channel structure and fish habitat—particularly coho salmon—is widely recognized. The Stream and Lake Improvement Program initiated by CDFG now evaluates the need for any LWD removal. Debris jams that are documented barriers to upstream migration can currently be modified to allow passage, but there is no longer any large scale removal of woody debris from channels. Woody debris that enhances fish habitat and provides channel structure and stability is left in place. Moreover, restoration projects now place LWD in streams to improve fish habitat.





12.2.7 Watershed and fisheries

Past forest practices have left a legacy of impacts on the aquatic and riparian habitats in the plan area, including

- Simplified stream channels.
- Adverse levels of stream sediments.

- Degraded riparian function.
- Channels and riparian areas depleted of LWD.
- Roads poorly planned and constructed.

Our conservation measures will improve aquatic and riparian habitats in the plan area and reduce cumulative effects on these habitats. Improvements should result from

- Maintaining or increasing the density of large trees in riparian zones.
- Maintaining or increasing the canopy density within the riparian zone.
- Limiting timber harvests on potentially unstable hillslopes.
- Reducing the adverse impacts of roads and stream crossings.

By restricting the type and amount of harvesting that can take place in a watershed, MRC will minimize the potential adverse impacts of timber harvest on peak flows, runoff, and water yield. These measures, together with site-specific guidelines in individual PTHPs, should maintain natural hydrologic regimes and protect the quality of water in MRC streams. This, in turn, should ensure that populations of salmonids remain stable or increase in the plan area even though timber harvests continue.

12.2.8 Hydrology

In forested landscapes, such as the plan area, timber harvests and roads may alter a catchment's hydrology by affecting the timing, volume, and rate of runoff. Removal of tree canopy increases the amount of precipitation that reaches the forest floor; since there is less vegetation to catch the precipitation, it evaporates before reaching the ground (Dunne and Leopold 1978).

12.2.8.1 Rain-on-snow

In areas where precipitation may fall as either rain or snow, timber harvests can increase the amount of snow that accumulates in logged areas; this also increases the likelihood of floods from rain-on-snow conditions. The plan area does not receive any significant snow accumulations that could contribute to rain-on-snow events.

12.2.8.2 Fog

A reduction in forest canopy may also decrease fog interception and fog drip; this would reduce soil moisture and stream flow in portions of the plan area that experience substantial summer fog (Harr 1982, Ingwersen 1985; as cited in Keppeler 1998). The removal of trees and other vegetation during timber harvests decreases the amount of water removed from the soil by roots and dissipated through evapotranspiration. Therefore, in harvested areas, soil moisture levels are higher during the growing season; the first (usually small) storm-flow peaks in the fall are increased (Ziemer 1998). Removal of more forest vegetation from a basin can increase the potential for peak flows (Hibbert 1967, as cited in Keppeler 1998).

12.2.8.3 Peak flow

Observations of increased peak flows at the watershed scale due to logging roads or other compacted surfaces (skid trails, landings, cable-yarding corridors, or fire-lines) have been inconclusive. Some hydrologic studies associate logging and road construction with a significant increase in peak flows (Harr et al. 1979; Jones and Grant 1996); other studies do not (Ziemer 1981a; Wright et al. 1990; Duncan 1986; Lewis et al. 2000). However, drainage from roads or other compacted surfaces can alter the stream-flow at localized sites. Roads and skid trails have the capacity to channel surface runoff and route water to stream channels; this increases hydrologic connectivity, as well as runoff and peak flows within a basin (Wemple et al. 1996).

Roadside ditches and drainage culverts channel runoff and intercept subsurface flow, routing water to stream channels more quickly and directly than in an undisturbed landscape (Murphy 1995). The failure of drainage structures, such as culverts, at stream crossings can also reroute surface runoff from one channel to another, potentially altering peak flow magnitude and timing (Furniss et al. 1998).

Long-term research suggests that peak flows in the Caspar Creek Experimental Watershed, which is a gauged stream, were not substantially affected by roads, soil compaction, or overland flow (Ziemer 1998). However, because the approximate road density of the MRC plan area (6.9 mi/mi^2) is greater than the road density in the Caspar Creek Experimental Watershed (5.7 mi/mi^2), this may impact peak flows in the plan area during the short term In time, the MRC road plan should reduce road density in the plan area to a value similar to that in the Caspar Creek Experimental Watershed. We designed our road management plan to minimize possible adverse impacts from hydrologic changes and erosion due to human intervention. The road management plan will use state-of-the-art technology and science to

- Inventory all roads.
- Develop a long-term road system plan.
- Provide road and landing design.
- Provide construction and reconstruction standards for
    - Road inspection and maintenance.
    - Road and landing closure and abandonment.
    - Road use.
- Provide standards for water drafting and skid trails.

Peak flow response to timber harvests in the Caspar Creek Experimental Watershed appears to be primarily influenced by reduced vegetative cover (Ziemer 1998). The primary effect of logging on peak flow is an increase in the size of the smallest peaks during the driest antecedent conditions (i.e., in the fall before the onset of heavy winter rains, when soils are driest). This effect appears to diminish as the amount of rainfall and the initial wetness of the watershed increases (Ziemer 1998). In Caspar Creek Experimental Watershed, peak flow increases from early season storms averaged 35% for tributary watersheds that were entirely clearcut and 16% in partially clearcut watersheds. Ziemer (1998) concluded that these were relatively benign hydrologic increases in terms of their channel forming processes. Over the period of our HCP/NCCP, median peak flow increase during years of average wetness in MRC planning watersheds is estimated at 6.8% as compared to average flow conditions in a fully forested, second growth watershed (see section 8.4.3.1).

12.2.8.4 Low flow

Most studies, including those conducted in the Caspar Creek Experimental Watershed, show increases in low flows following timber harvests (Keppeler and Ziemer 1990, Ziemer et al. 1996, Keppeler 1998). Research in the Caspar Creek Experimental Watershed indicates that stream-flow changes due to logging are most evident during the summer. Substantial increases lasting 7 years followed selection harvest; potentially longer time periods could follow clearcuts (Keppeler 1998). Data from Caspar Creek Experimental Watershed show that the potential loss of fog drip following logging did not reduce stream-flow (Keppeler 1998). Any decreases in soil moisture due to reduced fog drip are apparently balanced by reduced evapotranspiration as a result of vegetation removal. With forest re-growth, flow diminishes, returning to pre-harvest flow conditions after about 12 years (Keppeler et al. 2003).

Throughout the term of our HCP/NCCP, MRC does not expect timber harvests to threaten aquatic resources or other beneficial uses of water. For watercourses within the plan area, our timber harvests should result in little if any short-term increases in summer flow relative to current conditions. Low flows in summer potentially benefit salmonids by temporarily increasing habitat available for juvenile rearing (Hetherington 1988).

12.2.8.5 Water drafting

Water drafting involves the siphoning of stream flow into a water truck. Periodically, the siphoned water is sprayed or applied to road surfaces to minimize dust production and maintain a hard, compact road surface. Gravity systems may also provide water directly to storage reservoirs or tanks for later use in dust abatement or fire suppression. MRC does not expect water drafting to threaten incubating or rearing salmonids because of the restrictions and monitoring associated with lowering flows.

12.2.9 Soils and geology

Soil productivity
Soils in the assessment area will continue to be subject to erosion from both natural and anthropogenic causes during the term of our HCP/NCCP. Timber harvests can cause substantial soil disturbance, including compaction and scarification (Spence et al. 1996). The effects of soil compaction, which include reduced infiltration capacity and increased surface runoff, may alter hydrologic response and increase sediment delivery to streams. Cafferata (1992) found that tractor yarding can result in the compaction of 10-40% of a harvested area; these effects may persist for several decades.

Surface erosion and mass wasting, which can have detrimental effects on water quality and aquatic habitat, should decrease as we minimize sediment delivery to streams and implement our road plan.

12.2.10 Water quality and human uses

12.2.10.1 Suspended sediment and turbidity

Timber harvests that increase inputs of fine sediment to streams can degrade water quality and threaten aquatic species. Fine sediment, created from surface erosion, mass wasting, and bank erosion, can increase suspended sediment concentrations and turbidity; this may have detrimental effects on aquatic species and water quality. Lewis (1998) reported increased suspended sediment concentrations following logging in the Caspar Creek Experimental Watershed; he determined the concentrations were closely correlated with increased storm-flows. Municipal and domestic uses of water occur both within and downstream of the plan area; fine sediment inputs from timber harvests and road construction could affect these water sources. The City of Fort Bragg has identified turbidity caused by fine sediment as a primary water quality concern for its drinking water supply (SHN 1995).

Our HCP/NCCP will minimize the impacts of suspended sediment primarily through our strategies for mass wasting, sediment, and road maintenance. Habitat conservation strategies for riparian function provide additional protection. The following practices protect water quality by reducing fine sediment delivery to streams:

- Restrictions on timber harvest, as well as on construction of roads, landings, and stream crossings in Terrain Stability Units (TSUs) with the greatest potential for mass wasting.

- Proper design, location, construction, and maintenance of roads to reduce (a) mass wasting from road failures and (b) surface erosion from the construction, use, and maintenance of roads.
- Identification and closure or abandonment of improperly closed roads to reduce their sediment contribution.
- Regular road inspections to (a) identify problem sources of sediment and (b) prioritize maintenance.
- Designation of over 50% of the MRC road network to temporary use only.
- Prescriptions for improved skid trail, cover, soil management, and silviculture to reduce surface erosion and mass wasting from timber harvests.
- Restrictions on heavy equipment use in the AMZs to minimize soil compaction, bank instability, and surface erosion.
- Restrictions on site preparation and burning in the AMZs and on steep slopes adjacent to watercourses to (a) minimize surface erosion and removal of understory vegetation and (b) maintain LWD for sediment storage.

Estimates suggest that approximately 60% of sediment inputs in the plan area during the last 30-40 years have been from landslides. Road use and timber management contribute to the remaining 40%. MRC will limit timber management in high hazard terrains (TSUs 1-3) to 5% over a 10-year period within each CalWater planning watershed. Our intent is to reduce sediment delivery due to mass wasting and retain at least 50% of the overstory canopy in these managed units.

To date, MRC has identified 16,000 sources of controllable erosion, 38% of which have high or moderate potential for sediment delivery. As of 2011, the MRC road inventory is 90% complete. Completion should occur in 2012. We will control 1,302,000 yd^3 of controllable erosion over the first 30 years of our HCP/NCCP (O§8.3.2-6). In addition, in the first 20 years of our HCP/NCCP, MRC will treat controllable erosion at sites designated high and moderate priority and at road-related restoration sites in coho core areas (see Tables 8-18 and 8-19). Abandonment of roads will also substantially decrease the number of stream crossings. Based on current road inventory, there are 2300 miles of roads in the plan area. Less than 3% of these roads are paved; roughly 78% of them have only a native surface. Reducing the length of riparian roads and the number of stream crossings will reduce the potential for sediment delivery to streams and improve water quality. MRC estimates that new road construction over the first 10 years of our HCP/NCCP will outpace road decommissioning. However, the plan area will only end up with roughly 20 net miles of new roads. New roads will meet more stringent guidelines to reduce sediment input. Decommissioning will focus on roads in the worst condition. In addition, MRC will designate about 50% of the road network in each planning watershed for temporary use; currently about 25-30% of MRC roads are for temporary use. This change will reduce road activity, maintenance, and potential erosion. Temporary road use will also reduce the number of permanent features (e.g., culverts and stream crossings) in each planning watershed to the benefit of covered fish species.

Harm to covered fish species will still occur under our HCP/NCCP as a result of sediment delivery; local habitat conditions will continue to impair the ability of individual fish to grow, rear, migrate, or spawn. However, our HCP/NCCP will likely result in substantially less sediment delivery than current management practices and subsequently improve aquatic habitat conditions.

12.2.10.2 Nutrients

The effects of forest management on nutrient cycling in coastal northern California are not clear (Dahlgren 1998). While some researchers have identified nutrient losses from leaching, erosion, and loss of plant biomass following timber harvest (Likens et al. 1970, Johnson et al. 1982, 1988, Hornbeck et al. 1987; all as cited in Dahlgren 1998), short-term nitrogen increases have resulted from reduced nutrient uptake, increased subsurface flow, increases in leachable forms of nitrogen compounds, and increases in decaying organic material (Reid 1993). Many evaluations of nutrient changes after logging have focused on nitrogen (Dahlgren 1998, Reid 1993), apparently a limiting factor in many west coast forest ecosystems (Dahlgren 1998).

In the Caspar Creek Experimental Watershed, Dahlgren (1998) examined the effects of clearcut (even-aged) logging on nitrogen in stream water. Dahlgren found that the release of nutrients from organic matter increased nitrate concentrations and reduced nutrient uptake by vegetation following timber harvests. Nitrate levels in stream water were highest during high stream flows following storms; downstream, there were near reference levels due to dilution and possibly instream immobilization. Although substantial amounts of nitrogen were lost from harvested vegetation, nutrient losses were low relative to the total site nutrient capital and input mechanisms. This is due in part to rapid re-growth and nutrient uptake by redwood stump sprouts, shrubs, and herbaceous plants.

Based on the Caspar Creek study, increased nitrogen levels are not likely to occur in streams draining harvested watersheds in the plan area. MRC will rely more and more on uneven-aged management. Short-term minor increases in stream nutrients associated with rehabilitation or other intensive silvicultures will be very limited because MRC does not rely on broadcast burning for site-preparation purposes. Uneven-aged management appears to have a minimal effect on stream nitrogen concentration when compared to other types of timber harvests. This management prescription should ensure that timber harvests in the plan area do not result in adverse impacts to water quality as a result of nutrient loading.

12.2.10.3 Dissolved oxygen

Dissolved oxygen in streams draining steep, forested watersheds is generally maintained at or near saturation levels by re-aeration of flowing water (Murphy 1995). Depletion of dissolved oxygen relative to timber management can result from algal blooms. The cause is increased nutrient inputs and increased oxygen consumption by decaying organic materials (Kopperdahl et al. 1971, Ringler and Hall 1975, Reid 1993). Large increases in stream water temperature may also reduce dissolved oxygen concentrations.

Forest management practices that include riparian zone protections should not deplete dissolved oxygen in stream water under normal circumstances (MacDonald et al. 1991). Reduced concentrations of dissolved oxygen following logging apparently return rapidly to pre-harvest levels (Ringler and Hall 1975). MRC does not expect timber harvests under our HCP/NCCP to decrease dissolved oxygen and cause detrimental impacts to downstream water quality.

12.2.10.4 Pollutants

Chemicals used for forest management have the potential to introduce pollutants into the soil, groundwater, and stream network. This can cause direct or indirect effects to aquatic systems (Spence et al. 1996, Norris et al. 1991). Herbicides, insecticides, fertilizers, and fire retardants are the most commonly used chemicals for forest management. Herbicides and insecticides are highly variable in their chemical properties and potential effects on aquatic resources. Fire retardants may have lethal consequences to rainbow trout if not highly diluted (Buhl and Hamilton 2000).

Currently there is no information to indicate that any herbicides are contaminating surface water in the plan area. Nitrogen, in the form of urea, is the most commonly used forest fertilizer; it has the potential to increase production of aquatic resources under certain conditions or create various levels of toxicity to aquatic biota (Norris et al. 1991). Fire retardants have the potential to affect aquatic ecosystems, although the impacts have not been extensively studied (Buhl 2006). Potential impacts of forest chemicals on aquatic systems depend on many variables including chemical properties, method of application, and local conditions such as soil and weather.

Petroleum products, including fuels and oil that may be used or discharged (e.g., spills and leaks) during timber harvest operations, have the potential to create pollution concerns. The use of heavy equipment and gas-powered tools creates the potential for petroleum products to be introduced into soils, groundwater, and streams. Numerous state and federal regulations, such as the Clean Water Act., address restrictions and measures to reduce the potential for petroleum pollution.

The potential effects of chemical pollutants on terrestrial and aquatic biota depend on the movement and toxicity of the chemical, as well as its fate and persistence in the environment (Norris et al. 1991). The MRC Management Plan (2010) sets restrictions on the introduction and application of chemicals in the aquatic environment.

MRC does not expect our HCP/NCCP to increase the potential for pollutants to affect water quality or aquatic resources in the plan area. In addition, to reduce potential impacts to aquatic environments, we have limited the use of herbicides. We will continue to experiment with a variety of alternatives—manual methods, vinegar, corn gluten, eucalyptus oil, neem tree oil, and others—and monitor experimental sites for impacts to water quality.

12.2.11 Water supply

Impacts to water supply may include the amount and quality of water available for municipal and domestic use. Erosion from timber harvests and roads may produce sediment and turbidity in municipal and domestic water supply (section 12.2.10.1). MRC does not expect implementation of our HCP/NCCP measures to substantially influence local water supply. The most likely hydrologic response to timber harvest would be short-term increases in peak flow and low flow.

12.2.12 Water temperature

12.2.12.1 Impacts of management activities

The effects of timber harvests on stream water temperatures have been well-documented (e.g., Burns 1972, Ringler and Hall 1975, Beschta et al. 1987, Beschta et al. 1995). Loss of canopy shading following logging increases the amount of solar radiation reaching the stream; this causes increased maximum temperatures and greater diel fluctuations (Beschta et al. 1995). Temperature increases are typically greatest during the summer (MacDonald et al. 1991), when stream temperatures are naturally at their peak due to maximum incident radiation. These effects tend to be greatest in small streams (Beschta et al. 1995, Spence et al. 1996), because the influence of solar radiation diminishes with increasing stream depth and discharge

Long-term effects of timber management on stream temperatures depend on a number of interrelated factors, including the spatial distribution of harvesting, the amount of over-story canopy removed, and the management of riparian vegetation following harvesting (Beschta et al. 1995, Spence et al. 1996). Cafferata (1991) measured a mean increase of 3.4ºF (1.9ºC) in maximum summer stream temperature downstream of a 6-year-old clearcut at JDSF in the South Fork Noyo River watershed. In this study, riparian shading was reduced by 14% as a result of harvesting. Other studies of coastal watersheds in the Pacific Northwest have shown increases in average summer maximum stream temperatures of up to 14ºF (8ºC) following clearcut logging (Beschta et al. 1987) and average diel temperature fluctuations of 6.7ºF (3.7ºC) (Holtby and Newcombe 1982, as cited in Spence et al 1996). The orientation of a stream (e.g., north-south vs. east-west), the steepness of adjacent hillslopes, and the amount of groundwater and subsurface flow can also affect the magnitude of temperature increase following riparian canopy removal (Cafferata 1990, Beschta et al. 1995, Murphy 1995).

12.2.12.2 Effects on habitat suitability

Elevated water temperatures can affect stream biota in a variety of ways. The growth and productivity of many aquatic organisms may increase as a result of higher water temperatures following timber harvests (Beschta et al. 1987). Greater light levels after removal of riparian vegetation can stimulate primary and secondary productivity (Erman et al. 1977, Hawkins et al. 1982). As a result, populations of vertebrate predators, including salmonids, have increased (Hawkins et al. 1982, Murphy and Hall 1981, Murphy and Meehan 1991). Further abundance of primary producers and benthic macroinvertebrates, however, is generally accompanied by reduced species diversity (Bilby and Bisson 1992, Beschta et al. 1995); increased fish production is usually short-lived (Sedell and Swanson 1984). High water temperatures have adverse impacts on the growth and development of early anadromous salmonid and amphibian life stages and can reduce habitat suitability for adults as well (Spence et al. 1996). Egg incubation rates, emergence timing, and growth patterns are among the life history traits of anadromous salmonid influenced by increased water temperatures following logging (Hartman et al. 1987). Scrivener and Anderson (1984) found that elevated temperatures induced early emergence of coho salmon; the effects of early emergence included increased susceptibility to high winter flows, earlier outmigration, and reduced densities.

12.2.12.3 Resource trends and effectiveness of conservation strategies

Prescriptions for canopy retention in our HCP/NCCP should maintain cool stream temperatures by ensuring adequate streamside shading. Standards for AMZ width and canopy closure should limit adverse site-specific and downstream impacts on sensitive aquatic biota that could otherwise result from deleterious increases in maximum summer stream temperatures. By protecting riparian ecosystem integrity, these measures should maintain other key functions of riparian forests, such as LWD input, streambank stabilization, organic matter input, and terrestrial wildlife habitat (Spence et al. 1996).

Louisiana-Pacific, the previous owner of the MRC lands, initiated summer temperature monitoring in 1989 at a limited number of sites. Currently, MRC is monitoring approximately 100 sites. These monitoring sites are primarily on Class I watercourses, with additional Class II watercourse sites to be added. We monitor most watercourses with 1 station. However, on larger streams, we use multiple stations. Temperatures at some locations have occasionally exceeded maximum weekly average temperature (MWAT) thresholds for juvenile coho salmon. For the most part, the highest summer stream temperatures were recorded in watercourses in the eastern portions of the plan area. MRC has recommended riparian buffers of varying widths to protect stream water temperatures for salmonids.

Murphy (1995) cites Johnson and Ryba (1992) in recommending a width of 80 ft (25 m) to provide adequate stream shading. Spence et al. (1996) review various recommendations and conclude that a buffer width equal to 3/4 the height of 1 site-potential tree is sufficient to fully protect stream shading, litter inputs, and nutrient regulation. Depending on slope, MRC will establish 130 to 190-ft AMZs on Class I streams (3/4 to 1 site-potential tree height adjusted to slope distance) and 100 to 150-ft AMZs on Large Class II streams (1/3 to 4/5 site-potential tree height). Buffers for stream shading can be smaller on small Class II and Class III watercourses as there is no surface flow that can be heated by solar isolation during summer. Shade is unnecessary because these small watercourses do not deliver surface-exposed water to Class I and Large Class II watercourses during the summer when temperatures are a concern. MRC riparian conservation measures include 50 to 100-ft wide AMZs on small Class IIs (1/3 to 3/4 site-potential tree height) and 25–50 ft on Class IIIs (1/6 to 1/3 site-potential tree height).

The effectiveness of riparian buffers for providing stream shading and maintaining cool water temperatures also depends on the density of canopy closure within the buffer. The site-specific conservation measures for riparian areas will maintain high levels of streamside shade along Class I and Class II streams; there will be 85% over-story canopy in the inner zone and 70% in the middle zone of Class I and large Class II AMZs.

12.2.12.4 Fish habitat

Within watersheds, physical and biological processes influence habitats for aquatic species. In the Pacific Northwest, freshwater habitat for salmonids is particularly susceptible to the types of disturbances created by forest management (Beschta et al. 1987, 1995; Reid 1993, Murphy 1995, Spence et al. 1996). Coho salmon, Chinook salmon, and steelhead are the anadromous salmonids that occur in MRC streams and for which MRC is seeking coverage under the incidental take permit. The analysis presented in this section, therefore, focuses on the potential impacts of forest management on habitat for these species in MRC streams. Some key habitat requirements are summarized below to provide background for this analysis.

While in fresh water, anadromous salmonids require specific habitat requirements during spawning, incubation, summer rearing, and winter rearing (Everest et al. 1985, Bjornn and Reiser 1991). Adults returning to spawn need access to spawning riffles, that are comprised of relatively silt-free gravel of adequate size (Platts et al. 1979), and nearby cover such as deep pools, overhanging vegetation, or LWD (Bjornn and Reiser 1991). Spawning also requires suitable water depth and velocity, as well as adequate space and gravel for construction of redds (Bjornn and Reiser 1991). The amount of fine sediment in the spawning gravels of redds and the amount of dissolved oxygen available to the eggs influences the survival from egg to emergence (Cloern 1976, Mason 1976a, Shirazi and Seim 1981). Spawning salmonids need relatively cold water temperatures; juvenile coho salmon and steelhead also require cold temperatures for growth and survival (Bjornn and Reiser 1991).

Juvenile rearing success is closely related to the availability of food and cover (Chapman and Bjornn 1969). Substrate heterogeneity, water temperature, oxygen levels in the water, and nutrients, all influence the production of invertebrate food resources (Minshall 1984). LWD is an important source of cover for rearing salmonids; it is also crucial to the formation of pools and the retention and spatial distribution of sediment (Fausch and Northcote 1992, Cederholm 1994). Juvenile and adult salmonids use pools as cover in summer and winter (Tschaplinski and Hartman 1983, Bjornn and Reiser 1991, Meehan and Bjornn 1991). They can serve as cold-water refugia when water temperatures are high elsewhere in the stream (Nielsen et al. 1994). Important sources of cover also include coarse substrates, overhead vegetation, undercut banks, and backwater or off-channel areas; the latter are especially important during high winter flows (Nickelson et al. 1992).

12.2.12.5 Impacts of forest management

Timber harvests and roads have the potential to substantially influence the input of water, sediment, heat, and wood to streams. These inputs are the major determinants of stream-channel geomorphology; together with food and water quality, they constitute the key components of salmonid habitat.

Timber harvests can increase inputs of fine and coarse sediment to streams by accelerating the rates of mass wasting and surface erosion (Hicks et al. 1991a). Increased mass wasting in response to timber harvests primarily occurs due to localized changes in soil hydrology and decreased root strength (Beschta et al. 1995). Loss of root strength is likely of lesser importance in the redwood and mixed redwood/Douglas-fir forests that occur in the plan area since the root system of redwoods often remains alive after harvesting. In an Oregon study, clearcutting approximately tripled hillslope failure rates relative to undisturbed conditions (Swanson and Dyrness 1975, as cited in Beschta et al. 1995). In contrast, research in Caspar Creek Experimental Watershed suggests that the incidence of shallow landsliding in cable-yarded clearcut units without midslope roads did not increase significantly relative to unlogged areas (Cafferata and Spittler 1998). This indicates that current timber and road management may reduce the impacts of logging on mass wasting.

Surface erosion in harvested areas generally occurs where the soil surface is disturbed or compacted by yarding and other ground-based activities (Hicks et al. 1991b, Reid 1993, Murphy 1995). Loss of the organic surface layer of the soil and formation of a hydrophobic layer following fire can further increase susceptibility to surface erosion (Spence et al. 1996). Compared to tractor yarding, which involves extensive road and skid trail systems and ground-based heavy equipment, cable and helicopter yarding produce less soil disturbance; as a result, they have less potential for erosion (Beschta et al. 1995).

Increases in sediment delivery to streams may also result from accelerated erosion of stream banks caused by harvesting in riparian areas (Hicks et al. 1991b). Physical disturbance and loss of root strength increase the susceptibility of banks to stream erosion. The impacts of increased sediment production on aquatic habitats depend on the amount of sediment that is actually delivered to the stream (Spence et al. 1996). Therefore, harvesting in riparian areas or inner gorges generally presents a greater risk of aquatic habitat degradation than harvesting elsewhere in a watershed. Moreover, timber harvests usually involve the construction of roads, ditches, and skid trails; these can channel sediment to streams and exacerbate the effects of upslope management activity on anadromous salmonid habitat.

The total sediment contribution from roads can be greater than from all other management activities in a watershed combined (Gibbons and Salo 1973, as cited in Furniss et al. 1991, May 2002). Road construction can increase slope failure rates by 25 to 400 times relative to undisturbed conditions (Sidle et al. 1985, as cited in Beschta et al. 1995). Road systems affect slope stability primarily by modifying natural drainage patterns (Reid 1993, Sidle et al. 1985, as cited in Beschta et al. 1995). Roads, skid trails, and landings can often contribute large amounts of fine sediment to streams via surface erosion (Chamberlin et al. 1991). If the road network is in close proximity or hydrologically connected to the channel network, this will greatly increase sediment delivery (Rice et al. 1979, Furniss et al. 1991, Ketcheson and Megahan 1996, Flanagan et al. 1998). Stream crossings, culverts, and other drainage structures can be chronic sources of erosion. Catastrophic failure of stream crossings input large amounts of sediment to streams (Flanagan et al. 1998). Best et al. (1995) found that 80% of all road-related erosion in a Humboldt County (CA) watershed was from stream crossing locations; the cause was diversions from plugged culverts and failed road fills.

Road surfaces are susceptible to sheetwash erosion and channelized runoff from compacted surfaces (Chamberlin et al. 1991, Spence et al. 1996). Road surfacing and traffic can also affect erosion potential. Reid and Dunne (1984) found that nearly all sediment from road surface erosion originated from the travel surface (tread). Paved roads produced only 0.4% as much sediment as heavily used gravel roads; the latter produce over 130 times more sediment than lightly used gravel roads. The design, construction, use, and maintenance of the road network are, therefore, important determinants of how much sediment reaches streams.

Harvesting in riparian areas reduces the potential for recruitment of LWD to channels (Bisson et al. 1987, Hicks et al. 1991b). These effects can be long-term, especially if harvests remove all recruitment sources of LWD. Recruitment of key pieces of LWD from second-growth forests may take many decades, depending on the size of the channel (Murphy 1995). Key pieces of LWD (a) are independently stable in the stream channel; (b) retain other debris or sediment; (c) substantially influence bed scour or deposition; and (d) provide complex habitat for anadromous salmonid. As existing pieces in the channel decay, LWD can decline for a period of nearly 100 years and may not recover fully for more than 250 years (Murphy and Koski 1989). If harvesting converts riparian stands to non-conifer species, stable, key LWD, which creates aquatic habitat, could remain low for even longer (Chan 1993, as cited in Murphy 1995). Woody debris from hardwood trees is generally less stable in stream channels and decays more rapidly than that from conifers (Beschta et al. 1995). Redwood LWD can reside in stream channels for centuries (Keller et al. 1995). LWD is important for storing sediment, including spawning gravel, and organic material in stream channels (Murphy 1995). Depletion of LWD, therefore, diminishes the capacity of streams to retain fine sediment; less fine sediment means less spawning gravel for salmonids and less organic debris used by invertebrates and other stream biota for food and cover. Salvage logging and stream clearing, which removes pieces directly from channels, may deplete LWD and destabilize remaining pieces (Bilby and Ward 1989, Murphy 1995).
LWD greatly diversifies channel morphology and hydraulic conditions (Keller and Swanson 1979, as cited in Sullivan et al. 1987, Keller et al. 1995). Loss of LWD decreases pool scour potential and channel stability, thereby simplifying channel morphology (Bisson et al. 1987, Hicks et al. 1991b). Loss of LWD also reduces the amount of instream cover and pool habitat available for fish (Tschaplinski and Hartman 1983, Bisson et al. 1987).

12.2.12.6 Effects on habitat suitability

Land management that increases sediment inputs and bed scour while reducing LWD abundance, riparian vegetation, and stream flow can decrease available habitat, food, and survival for rearing salmonids. Fine sediment can reduce the suitability of spawning habitat by filling gravel interstices; this, in turn, reduces intragravel flow and dissolved oxygen for incubating eggs and developing alevins (McNeil and Ahnell 1964, Peters 1965, Moring and Lantz 1975). Reductions in dissolved oxygen can cause mortality, delayed hatching and emergence, smaller fry size, and increased incidence of developmental abnormalities (Alderdice et al. 1958, Coble 1961, Silver et al. 1963, Shumway et al. 1964, Mason 1976a, Shirazi and Seim 1981). Fine sediment may also form a seal or cap in the upper layers of redds (Einstein 1968), impeding or obstructing the emergence of alevins in a process known as "entombment" (Phillips et al. 1975). A reduction in stream flow can decrease rearing habitat, dewater redds, or impede migration.

Reach-scale aggradation and reduction of average bed substrate particle size from increases in surface erosion and mass wasting can reduce pool quantity, pool quality, and availability of suitably-sized spawning gravels (Everest et al. 1987, Sullivan et al. 1987). Such changes to the channel-bed generally reduce the number of pool-riffle transition areas (pool tailouts) preferred as spawning locations. Filling of pools with coarse and fine sediments can reduce the carrying capacity of rearing habitats for juveniles (Bjornn et al. 1977, Lisle and Hilton 1991). In watersheds where past forest management created large fluctuations in sediment input to streams, previously aggraded channels may be down-cut. This reduces connectivity between the channel and its floodplain, as well as the availability of off-channel habitat. Increased loading of fine sediment may reduce aquatic invertebrate diversity and production, along with food availability (Crouse et al. 1981, Minshall 1984). Increased sedimentation from land management may also reduce habitat suitability by filling in the interstitial spaces in the substrate which juvenile salmonids use as cover from predators or as refugia during high flows or low temperatures (Hillman et al. 1987).

Researchers often cite LWD as the single most important habitat element that provides cover for anadromous salmonids (McMahon and Reeves 1989, Fausch and Northcote 1992, Cederholm 1994). LWD creates pools used for rearing, provides velocity refuge and cover from predators, and may moderate late summer temperature extremes (Keller et al. 1995).

Land management that results in loss of LWD tends to increase the amount of riffle area in streams and decrease pool area (Bisson and Sedell 1984). Removal of LWD results in fewer deep pools and less refuge from predation, high flows, and high summer water temperatures (Beschta et al. 1987, Bisson et al. 1987). LWD also plays an important role in nutrient dynamics by retaining carcasses of spawned salmonids (Cederholm and Peterson 1985).

12.2.12.7 Resource trends and effectiveness of conservation strategies

The habitat conservation measures of our HCP/NCCP should avoid or minimize the potential impacts of forest management on salmonid habitat. There is insufficient data to link forest management to effects on aquatic and riparian habitat and trends in salmonid populations across the plan area. MRC will evaluate the effectiveness of our HCP/NCCP in maintaining or improving salmonid habitat based on the adequacy of our conservation measures to minimize impacts and promote or accelerate natural recovery. MRC monitoring will focus on watersheds and attempt to establish causal linkages between salmonid survival at specific life stages and plan area management. This information will improve our conservation measures through the adaptive management plan.

Over 100 years of forest management has influenced salmonid habitat in MRC streams. Although this influence continues, some aspects of aquatic habitat in MRC streams appear to be recovering from past impacts. Recruitment of LWD to stream channels has likely increased since the mid-1970s compared to previous decades when CDFG called for removal of wood from streams. The CDFG intent was to clean out large debris jams left over from logging operations. Still LWD loading generally remains low in MRC streams. MRC watershed analysis has evaluated sediment inputs to streams in the plan area with initial estimates summarized by CalWater planning watershed. Research in the Caspar Creek Experimental Watershed indicates that the implementation of modern timber harvest practices has reduced sediment inputs to streams compared to previous practices (Cafferata and Spittler 1998).

Many of the most severe or chronic impacts should continue to influence stream habitat across the plan area. Accelerated mass wasting in inner gorges, initially instigated by splash dam logging, may continue to occur in some areas, potentially causing ongoing channel-bed aggradation. The surface erosion analysis conducted for watershed analysis indicates that roads continue to be a major source of fine sediment in streams. Removal of LWD in recent decades appears to have released sediment stored in channels and facilitated scour of some alluvial channels to bedrock. LWD loading is substantially lower in MRC streams than in streams draining unmanaged forests; as a result many streams have low pool frequency and depth, reduced habitat heterogeneity, and lack of significant sediment storage capacity.

MRC will base our efforts at road abandonment on results of watershed analysis. Our focus will be streamside roads, with an overall goal to decrease road miles in the plan area. We will remove road-stream crossings concurrent with road abandonment. MRC will follow our road management plan in abandoning, designing, constructing, using, and maintaining roads in the plan area. These best management practices should minimize road-related erosion.

By reducing the amount of sediment delivered from roads, the prescriptions of our HCP/NCCP should substantially benefit aquatic habitat in MRC streams. A reduction in fine sediment loading from road-related sources will potentially increase the quality of spawning gravel and incubation success; it will also increase the amount of rearing habitat by reducing pool filling and increasing interstitial space between bed substrates. Moreover, the removal of culverts at road-stream crossings on fish-bearing streams will help ensure unimpeded passage for migrating salmonids. Table 8-20 shows the decommissioned roads, crossings, and culverts in the plan area as of 2009, while Table 8-21 provides estimates for road work within the first 10 years of HCP/NCCP implementation.

Limiting the amount of tractor yarding, especially in inner gorges, should minimize sediment production from hillslopes in most erosion-prone areas. MRC will use cable yarding, which results in less ground disturbance and lower post-logging erosion rates, as the primary yarding method in steeper terrain. In the areas where slopes are generally not as steep (i.e., typically less than 50%), use of tractor yarding will equal or surpass cable yarding.

Density of large trees in MRC riparian zones should increase throughout HCP/NCCP implementation. Our habitat conservation measures for riparian areas retain a percentage of the largest trees, based on channel sensitivity (C§8.2.3.1.4-1). Minimum basal area retention ensures that large trees are abundant in riparian habitat and recruitment of LWD improves (C§8.2.3.1.3-1 to C§8.2.3.1.3-3). By maintaining or increasing LWD recruitment, our HCP/NCCP should increase LWD loading in MRC streams over current levels. This will accelerate recovery from the depleted conditions of stream cleaning. As more LWD is recruited to streams, pool formation and sediment storage will increase; this should enhance the habitat complexity for rearing coho, Chinook salmon, and steelhead. By retaining spawning gravel and organic matter as well as providing rearing habitat, LWD will increase spawning success and cover from predators during the summer rearing period. The deeper pools scoured by LWD could potentially serve as cold water refugia during periods of high water temperature; these deep pools, together with velocity refugia provided directly by pieces of LWD, may increase over-winter survival during periods of high flow. Throughout the term of our HCP/NCCP, such changes will gradually increase production potential and habitat suitability for salmonids within the plan area.

12.2.12.8 Conservation measures to protect salmonid habitat

Strategies in our HCP/NCCP designed to protect salmonid habitat include habitat conservation measures targeted at riparian areas and mass wasting, our road plan, and other management practices that are part of individual PTHPs. The following measures—all discussed in Chapter 8—will minimize the impacts of timber harvests and roads on salmonid habitat:

- Restrict timber harvests and road construction on potentially unstable hillslopes, including inner gorge areas, to minimize mass wasting potential and episodic delivery of large amounts of sediment to streams.
- Reduce mass wasting from road failures and surface erosion from construction, use, and maintenance of roads.
- Restrict road use to minimize sediment production, including during wet weather.
- Identify, re-close, or abandon improperly closed roads to reduce their sediment contribution.
- Inspect roads regularly to identify problem sources of sediment and prioritize maintenance.
- Restrict use of heavy equipment in AMZs to minimize soil compaction, bank instability, and surface erosion.
- Restrict timber harvest in inner and middle bands of AMZs to minimize effects on water temperature and LWD recruitment.
- Restrict site preparation and burning in AMZs and steep slopes adjacent to watercourses to (a) minimize surface erosion and removal of understory vegetation and (b) maintain LWD for sediment storage.
- Recruit LWD to stream channels to (a) maintain channel stability, pool habitat, instream cover, and sediment storage, and (b) help meter the delivery of sediment to downstream reaches.
- Restrict silvicultural treatments in the inner, middle and outer bands of the AMZ to ensure high levels of canopy shading, tree volume, and basal area.
- Implement standards for the installation of culverts on fish-bearing, Class I streams to ensure unobstructed upstream and downstream fish passage.

12.2.13 Vegetation and wildlife habitat

In some cases, MRC will manage sensitive and rare ecosystems and ecosystem components to ensure continuous functioning across the plan area; snags fall in this category. In other cases, MRC will protect such ecosystems and components to maintain hard-to-replace values for wildlife, such as Type I old-growth stands and rocky outcrops. By altering the distribution and relative abundance of the forest seral stages, we expect timber harvests in conifer and conifer/hardwood stands to mimic early successional stages. MRC will maintain protected conservation areas, such as old growth groves, as late successional stages. To limit disturbance, we will implement habitat conservation measures for wildlife trees, downed wood, old-growth trees and stands, pygmy forest, and rocky outcrops. We will enhance sensitive resources (e.g., by providing screen trees for old growth trees and snags) and rare ecotypes (e.g., by permitting prescribed burning in oak woodlands to mimic natural processes). While some timber harvests will occur within mid and outer bands of AMZs and adjacent forest, MRC will minimize impacts to stream and riparian habitat.

12.2.14 Old-growth and late-successional forest

MRC will protect the remaining old-growth trees in the plan area. The retention of individual old-growth conifer trees and old-growth groves will provide old-growth habitat elements in high and low densities across much of the plan area. In other areas, where we will only schedule limited harvest or no harvest (e.g., unstable areas and AMZs), we expect to maintain or enhance a network of late successional forest features.

Moreover, MRC will continue to manage our matrix forest for ecological values such as those from old growth trees, wildlife trees, and snags which provide wildlife habitat and ecological function. These matrix forests, managed with the proper care, will provide connective tissue between patches of old growth, AMZs, unstable areas, and other important habitat. Over the term of this plan, our AMZ forest stands and unstable areas are likely to develop more characteristics of late successional forest. This increasing trend of late successional forest features should provide beneficial outcomes for species such as the marbled murrelet, northern spotted owl, Vaux's swift, and silver-haired bat.

12.2.15 Forest structural stage diversity

While MRC has relatively few acres of old growth or mature forest, our long term use of uneven-aged management will allow stands to develop late-successional characteristics, such as tall tree height and large diameter, similar to old-growth stands. In general, large diameter classes (>24 in. dbh) will continue to increase in the plan area throughout the plan period. Stands with dominant diameter classes greater than 16 in. will make up most of the plan area over the term of our HCP/NCCP. By the end of that term, we expect the smaller size classes (<16 in. dbh) to decrease from the current estimate of 48% of the plan area to about 5%. The trend toward large trees will be most dramatic in watercourses that have been heavily harvested. In watercourses currently stocked with large trees, the trend will be more gradual.

12.2.16 Habitat elements

Wildlife relies on an abundance and diversity of habitat structural elements, such as large trees, snags, and LWD. MRC computer models allow for projected trends in density of large trees, but not of snags and LWD. According to these models, MRC expects the density of large trees (i.e., > 24 in. dbh) within AMZs of the plan area to increase substantially over the term of our HCP/NCCP. This will allow for a concomitant increase in large snags and LWD as well. The habitat conservation measures for riparian function, which include retaining a percentage of the largest trees per acre in the AMZ at each harvest entry, will ensure that (a) large trees are abundant in riparian habitat and (b) recruitment of large snags and LWD will continue throughout the term of our HCP/NCCP.

Projected patterns in large tree density differ somewhat among WAUs. MRC will generally promote large conifer stands with some very large trees and some very small recruitment trees. Hardwood stands capable of growing conifers will slowly trend toward a condition of conifer-domination. In watersheds that are already well stocked with large conifers and with few hardwood-dominated stands, the pattern of vegetation change will gradually trend toward even larger conifer stands. Where young conifer stands dominate, along with substantial hardwood competition, the pattern of vegetation change will be more dramatic.

With the habitat conservation measures for snags, the density of snags should reach a forest-wide goal of 1 to 2 snags per acre. MRC will retain existing snags across the plan area except where they pose a safety hazard. Snag densities should be highest in AMZs and old-growth management areas. The retention and recruitment of snags, which eventually fall to become LWD, along with the retention guidelines in the habitat conservation measures for downed wood, will provide for the distribution of LWD across the plan area over the term of our HCP/NCCP. Current levels of LWD across the plan area vary somewhat by watershed. There are approximately 6.4 logs per acre with an average diameter ≥ 16 in.

12.2.17 Rare habitats and habitat diversity

MRC expects to maintain the diversity of wildlife habitat in the plan area. We will protect rare habitat features, such as pygmy forest, seeps, springs, rocky outcrops, and natural meadows from disturbance. In addition, we will retain a portion of the hardwood component of conifer/hardwood forest stands during timber harvests, including the diversity of hardwood species and tree sizes that occur under pre-harvest conditions. Retaining islands of hardwood types during rehabilitation harvests across the plan area should allow this now common stand condition (seral-stage) to persist in the plan area but drastically reduce its dominance. Retention and enhancement of the diversity of vegetation types and ecosystem elements in the plan area will provide a diversity of habitat types for wildlife over the term of our HCP/NCCP.

12.2.18 Conservation easements and carbon credits

DEFINITION

A **conservation easement** is a legal agreement between a landowner and a government or non-profit organization that permanently limits use of the land in order to protect its natural, scenic, or historic value. The land is still privately owned and no public access is implied.

MRC currently maintains 2 conservation easements within the plan area:

- NAVARRO RIVER

  Save the Redwoods League holds the conservation easement to an area by the mainstem and north fork of the Navarro River. The easement is 225 ac, along 10 miles of river, immediately adjacent to Navarro River Redwoods State Park. MRC retains ownership of the land, while *Save the Redwoods* retains the harvest rights to the trees on the land.

- COMPTCHE HILL

  MRC completed an easement with Pacific Forest Trust (PFT) that provides “forever wild” protection to approximately 90 ac of mature redwood forest southwest of Comptche. The “forever wild” easement allows for (a) limited harvesting of hazard trees; (b) fuels management; and (c) response to catastrophic events. These allowances require consultation with PFT and maintenance of the property’s conservation value.

MRC is evaluating easement strategies for larger portions of the plan area to ensure permanent protection of old growth, oak woodlands, pygmy forest, the Lower Alder Creek Management Area (LACMA), marbled murrelet enhancement areas, and other special habitats. In addition, we are assessing "working forest" conservation easements to ensure light touch, restoration, and exemplary forestry practices near stream zones throughout the plan area.

12.2.19 Biodiversity

MRC will maintain the diversity of plants and animals in the plan through

- Protection of rare habitat types (O§9.6.2.2-2).
- Conservation strategies for riparian areas (section 8.2.3).
- Preservation and enhancement of late-seral and old-growth forest and habitat elements (O§9.4.2-1 to O§9.4.2-3).

- Ongoing presence of a variety of forest seral stages (O§9.6.1.2-2)
- Control efforts aimed at invasive species and introduced pests (O§9.7.2-1 to O§9.7.2-3).
- Minimization of interference with natural processes (O§9.6.1.2-1 to O§9.6.1.2-3)
- Establishment and maintenance of conservation easements (C§9.4.3.1-2 and Table 7-1).

Our HCP/NCCP will ensure that aquatic, riparian, and terrestrial ecosystems support the biological diversity that occurs in coastal Mendocino County.

12.3 Assessment of Take

For each covered species in the plan area, this section estimates the amount of take from covered activities. The specific method for estimating takes varies by species. In general, the bases for assessments of take are (a) field surveys; (b) observational data; (c) computer modeling of habitat impacts due to harvests; and (d) estimates of the effects of management activities. MRC typically conducted impact assessments by overlaying GIS maps showing the locations of covered activities with computer models of species habitat or natural communities. The basis for the location and distribution of the covered species in the region and in the plan area is survey data and historical information. MRC assessed activities within the plan area and possible effects on covered species qualitatively or quantitatively, depending on the data available. For the most part, estimates assume a "reasonable worst-case scenario" in which covered activities occur over the maximum area and intensity possible. As a result, we typically **overestimated** the amount of take that will actually occur during the term of our HCP/NCCP. Analyses may also assume that all suitable habitat is occupied, which will overestimate direct effects on covered species.

12.3.1 Coho salmon

12.3.1.1 Location and distribution in the plan area

Chapter 4 (section 4.2) provides a detailed species account of coho salmon, including geographic distribution, local distribution in the plan area, population trends, life history, and habitat requirements.

12.3.1.2 Suitable habitat in the plan area

Table 3-8 provides historical data on aquatic habitat conditions for major streams and rivers in the plan area from 1998 to 2008. This data is the basis for designating *potential suitable habitat* for coho salmon. This potential suitable habitat includes all Class I streams and associated riparian habitat within a 300-ft wide AMZ (150 ft on either bank) up to the natural limit of anadromy (i.e., the most downstream naturally-occurring fish passage barrier) where there is documented historical occurrence of coho salmon.

For Southern Oregon/Northern California Coasts coho salmon, a combined total of 44.8 stream miles and 5578.42 ac of known occupied and potential suitable habitat may be present in the plan area (Table 12-4); likewise, for the Central California Coast coho salmon, a combined total of 335 stream miles and 41,598.47 ac (Table 12-5).

12.3.1.3 Covered activities adjacent to suitable habitat

Coho salmon depend on the condition of surrounding forests and rangelands. The condition of the watersheds that drain these forests and rangelands controls the physical structure and chemical composition of the streams in which fish migrate, spawn, and rear. While there have been many studies on the effects of land use, including forest management, on aquatic ecosystems, the relationships between land use and stream productivity are complex.

MRC covered activities with the most potential to adversely affect coho salmon and their habitat are

- Timber harvest (harvesting, yarding, loading, and hauling).
- Construction, reconstruction, and maintenance of landings and skid trails.
- Construction and maintenance of roads.
- Construction and maintenance of stream crossings and culverts.

These activities can (a) alter natural hydrology; (b) lead to an increase in sediment input and turbidity; (c) reduce stream bank stability and input of LWD to streams; (d) reduce stream shade and floodplain connectivity; and (e) degrade water quality.

Changes in the distribution of precipitation reaching the ground, evaporation rates, the amount of precipitation intercepted by vegetation, and the amount of precipitation stored in the soil may impact runoff (Meehan 1991). Changes in natural flow regimes may, in turn, impact coho salmon. The timing and magnitude of stream flows, for example, provide the environmental cues for adult and juvenile migrations. This timing may cause dewatering of redds, displacement of fry or juveniles, or scouring of spawning gravels. Because juvenile coho salmon rear in freshwater for a year before emigrating to the ocean, potential changes to summer flows could affect the productivity of coho salmon.

Timber operations and road construction or maintenance that results in ground-disturbance could alter the rate and pathways of water movement resulting in erosion, road failures, landslides, sediment transport, and ultimately delivery to streams. Increases in sedimentation and turbidity affect fish physiology, behavior, and habitat. Physiological effects of turbidity on salmonids include gill trauma, altered blood sugar levels, and osmoregulatory function. Behavioral effects include avoidance of high turbidity, changes in foraging ability, increased predation risk, and reduced territoriality. Fine sediment may reduce salmonid spawning and rearing habitat quality and quantity. Deposition of excessive fine sediment on the stream bottom could (a) eliminate habitat for aquatic insects; (b) reduce density, biomass, number, and diversity of aquatic insects and vegetation; (c) reduce permeability of spawning gravel; and (d) block the interchange of surface and subsurface waters. Increases in fine sediments in low velocity stream reaches could also cover spawning gravel or reduce the number, volume, and depth of pools. Increases in fine sediments in low velocity stream reaches could also cover spawning gravel or reduce the number, volume, and depth of pools. Existing and future road crossings can result in the creation of barriers to fish migration. Barriers could reduce the amount of available habitat for spawning and rearing; this might lead to increases in predation of adults.

Substantial sediment input and deposition could (a) cause channel braiding; (b) increase width-to-depth ratios; (c) increase incidence and severity of bank erosion; (d) reduce pool volume and frequency; and (e) increase subsurface flow. In general, these actions tend to reduce habitat values by reducing the structural and hydraulic complexity of natural channels and preventing channel processes that sustain these values.

Despite conservation measures in place to reduce sediment inputs (section 8.3.3), harm to coho salmon will still occur under our HCP/NCCP; local habitat conditions will continue to impair the ability of individual fish to grow, rear, migrate, or spawn. However, MRC will substantially reduce sediment delivery within the plan area by (a) reducing the potential for mass wasting; (b) upgrading the road network; (c) decommissioning roads; (d) applying stringent conditions to the development of new roads; and (e) designating 50% of our road network to temporary use. All of these actions will reduce impacts to coho salmon and improve habitat conditions which currently may impair the survival rates of coho eggs and juveniles. Through monitoring and adaptive management, MRC will ensure, at a minimum, that

- Stream gravel permeability will, on average, approach or exceed 10,000 cm/hr across stream reaches.
- Percent of fine material < 0.85 mm will, on average, approach < 7% across stream reaches (using dry sieve techniques).
- Proportion of fine sediment in pools will, on average, approach < .21 across stream reaches (using V-Star methodology).

The removal of streamside vegetation during timber operations and road construction can reduce the number of trees available for recruitment to streams and affect the coverage and health of vegetation. Vegetation provides structural stability to stream banks. A reduction in vegetation could lead to a reduction in structural complexity in channels and cover within streams. Large wood is an important component of salmonid habitat in streams. Canopy removal that increases exposure of streams to solar radiation can increase water temperatures and the magnitude of daily temperature fluctuations. Temperature change can have direct and indirect effects on the growth, survival, and reproduction of fish.

The use of heavy equipment could result in accidental spills or inadvertent discharges of petroleum products (i.e., fuels, lubricants, and hydraulic fluids). The spill or accidental discharge of these materials adjacent to, or in a water body, could potentially affect the water quality of a stream, river, or wetland and thereby directly affect fish or their prey.

Water drafting has the potential to adversely affect coho salmon through (a) excessive withdrawal rates that reduce available water; (b) high intake velocities that entrain fish; and (c) inadequately-sized intake screens that allow fish to pass through. Withdrawing water from Class I streams with coho salmon present from April 1 to November 15 could interrupt smolt migration, de-water redds, and reduce juvenile rearing habitat for up to 24 hours, depending on the water recovery rate.

Water drafting demonstrably affects flow 450 ft or more downstream of the water drafting site (MRC 2002). All use of water drafting sites is episodic. MRC may not use a waterhole for several years, next use it for its allowed maximum capacity for 1-2 years, and then leave it alone for several more years. We use some drafting sites along mainline roads annually.

Other covered activities with the potential to adversely affect coho salmon include stream habitat improvement, as well as research and monitoring activities. Habitat improvement can lead to short-term increases in turbidity and sedimentation. However, the magnitude of these effects would be much less than those incurred with timber operations. Moreover, habitat improvement would ultimately benefit fish.

Research and monitoring activities could result in direct and indirect effects on fish. Fish surveys requiring the capture or handling of fish (e.g., electrofishing, trapping, and netting) may affect the growth or survival of juvenile coho salmon. Stream surveys could interfere with migration and spawning of fish; they could also result in the crushing and trampling of eggs in redds. Moreover, improper stream classification could trigger reduced protections to stream reaches (e.g., reduced buffer widths), thereby adversely impacting fish.

12.3.1.4 Mitigation that offsets the effects of forest management

MRC protects and conserves all 3 covered salmonids (coho salmon, Chinook salmon, and steelhead) and their respective life stages by focusing on their aquatic habitat. We have adopted standard conservation measures for all Class I streams because all salmonid life stages may be present in all fish-bearing streams at any time. AMZs support, in one way or another, the unique habitat requirements of each of the salmonid species. Our approach avoids the problems of single-species management. Overall, our conservation measures include

- Stream buffers.
- Improvements to riparian areas and enhancement of riparian functions.
- Equipment exclusion zones and restricted harvest in AMZs.
- Reduction of sediment input to streams from roads and timber harvests.
- Monitoring stream flows during water drafting.
- Culvert upgrades.
- Enhancement of stream habitat.
- Monitoring surveys.

Combined, these measures will reduce sediment input to streams, avoid creating barriers to fish migration, and enhance riparian function while at the same time minimizing impacts in AMZs. This will ensure that take of Central California Coast coho salmon is also minimized or avoided. In addition, the proposed and ongoing survey and monitoring efforts will ensure that MRC identifies occupied and suitable habitat for coho salmon. If future surveys result in the designation of additional Class I streams or determine new reaches where suitable habitat for coho salmon exist, MRC will afford these streams and reaches the conservation measures adopted for the 3 covered salmonids.

12.3.1.5 Level of expected take

MRC conservation measures should minimize the incidental take of Southern Oregon/Northern California Coast and Central California Coast coho salmon because they protect (a) water quality (e.g., from turbidity, increased water temperature, and pollutants); (b) spawning substrate (e.g., by avoidance or reduction in anthropogenic sediment loading); (c) flow disruption (e.g., by following water drafting guidelines); and (d) habitat complexity (e.g., through bank stability, increased pool depth, improved riparian function, and recruitment of LWD). In addition, implementation of habitat improvements, such as replacement of instream structures, channel realignment, and bedload reduction should benefit coho salmon, especially in areas that have not yet recovered from the impacts of historical logging practices.

If MRC does not accurately designate stream classes, this could result in reduced protections and habitat quality for coho salmon. However, we believe this potential risk of take is low. MRC will ensure accurate classification of stream channels and identification of key habitat through watershed analysis, biological monitoring (fish and habitat surveys), and other related riparian strategies.

Some direct take of coho salmon (Central California Coast ESU) may occur as a result of water drafting. An MRC study (2002) of water drafting recorded the time it took 52 waterholes to fully recover from pumping and how far downstream flow was affected. MRC staff measured flow downstream at intervals of 43 ft, 95 ft, 220 ft, 330 ft, and 450 ft. They observed flow reduction up to 450 feet downstream of the drafting site.

For coho salmon (Southern Oregon /Northern California Coast ESU), there are 7 water drafting sites in Hollow Tree Creek. MRC classified 5 sites as recovering fast (in less than 6 hours) and 1 site as slow to recover (in 24 hours). For coho salmon (Central California Coast ESU), there are 55 water drafting sites in potential coho habitat. MRC classified 26 of these sites as recovering fast, 13 as recovering slowly, and 9 as undetermined. Water drafting could result in direct take of coho eggs by dewatering redds or indirect take of juvenile or smolt coho salmon by reducing rearing or migratory habitat for up to 24 hours. In our HCP/NCCP *Atlas*, MAPS 22A-C show the water drafting sites in the plan area and MAPS 23A-C show the waterhole recovery rate for coho salmon.

MRC proposes to minimize impacts of water drafting by not

- Withdrawing more than 10% of the daily above-surface flow.
- Reducing maximum pool depth by more than 10%.
- Drafting in watercourses that have less than 1 cfs of surface flow.

To address intake velocities and screen size, MRC will follow water drafting guidelines prepared by NMFS (1997). We will also follow other guidelines described in Appendix E, section E.7, *Standards for Water Drafting*.

In the plan area, the take of coho salmon (Southern Oregon/Northern California Coast ESU and Central California Coast ESU) will most likely occur at waterholes when there is a reduction in the flow of water. We decided to capture the effect of drafting both at the waterhole and 200m downstream from the waterhole. In order to quantify take, we averaged the width of drafting holes across the property; this came out to be 4m. We then multiplied the average waterhole width (4m) by the selected downstream length (200m). Fish densities across the plan area vary annually as well as site-to-site. Based on MRC data for the plan area, the average of mid-to-high densities is 1 coho/m^2. The amount of waterholes which MRC will use per year will vary depending on the number and location of projects across the plan area. We estimated that in years of heavy activity, we may use approximately 4 sites in the SONCC ESU and 8 sites in the CCC ESU. Incorporating all this information, the equation for the number of CCC coho potentially harassed is: 1 coho/m^2*(4m*200m) *8 sites = 6400 coho per year. Similarly, the equation for the number of SONIC coho potentially harassed is: 1 coho/m^2*(4m*200m) *4 sites = 3200 coho per year. Table 12-3 shows the potential take of coho from water drafting for the 80-year term of our HCP/NCCP. Tables 12-4 and 12-5 show the potential impacts for coho habitat for that same time period.

Table 12-3 Potential Take of Coho from Water Drafting

Potential Take From Water Drafting in the Plan Area								
Decades								
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Central California Coast (CCC) Coho Salmon								
64,000	64,000	64,000	64,000	64,000	64,000	64,000	64,000	512,000
S. Oregon/N. California Coasts (SONCC) Coho Salmon								
32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	256,000

Table 12-4 Coho Salmon - SONCC

Total Stream Miles, Habitat Acres, and Habitat Harvested in the Plan Area for Southern Oregon/Northern California Coasts (SONCC) Coho Salmon										
WAU	**Miles of Class I Streams**	**Total Acres of Class I Habitat (AMZs)**	**Potential Acres Harvested Within Class I Habitat By Decade**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
* Hollow Tree Creek	44.8	5,578.42	-	-	57	251	673	748	861	788
Total	**44.8**	5,578.42	0	0	57	251	673	748	861	788
			****Total Acres Harvested = 3378**							

TABLE NOTES
* Indicates a known occurrence of the species. The species may not currently occupy all Class I streams in the watershed.
** Total Acres Harvested is the total number of acres harvested by decade and can include the same area previously harvested. Because of the overlap, the actual amount of newly harvested habitat may be less than the estimate.

Table 12-5 Coho Salmon - CCC

Total Stream Miles, Habitat Acres, and Habitat Harvested in the Plan Area for Central California Coast (CCC) Coho Salmon										
WAU	**Miles of Class I Streams**	**Total Acres of Class I Habitat (AMZs)**	**Potential Acres Harvested Within Class I Habitat By Decade**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
*Cottaneva Creek	12.8	1,607.49	-	-	16	59	194	132	242	151
Rockport Small Coastal Streams	17.3	2,098.76	-	-	-	-	81	168	183	334
*Noyo River	34.8	4,510.82	-	24	86	186	252	418	520	565
*Big River	71.8	8,500.61	-	10	191	387	350	732	904	1056
*Albion River	31	3,955.54	21	55	113	225	357	464	486	501
*Navarro River	106.3	13,422.42	40	81	336	550	834	1174	1138	1464
Greenwood Creek	19.9	2,490.81	-	-	196	173	321	227	355	250
*Elk Creek	20.3	2,394.51	5	10	144	343	453	417	487	428
*Garcia River	20.8	2,617.51	17	50	78	133	132	222	210	270
WAU Total	335.00	41,598.47	83	230	1160	2056	2974	3954	4525	5019
* WAU Total	**297.80**	**37,008.90**	****Total Acres Harvested = 20,001**							

TABLE NOTES
* Indicates a known occurrence of the species. The species may not currently occupy all Class I streams in the watershed.
** Total Acres Harvested is the total number of acres harvested by decade and can include the same area previously harvested. Because of the overlap, the actual amount of newly harvested habitat may be less than the estimate.

Research and monitoring activities, such as fish distribution and abundance monitoring as well as fish habitat surveys, could result in mortality, injury, or harassment to individual salmonids. This result would stem from capture and handling, as well as subsequent interference with feeding, migration, or spawning. Electrofishing and out-migrant trapping have the greatest potential for mortality or injury to salmonids. However, MRC will reduce the potential for mortality of individuals by limiting electrofishing to periods when water temperatures are no warmer than 18 degrees C. Moreover, MRC research will increase information about the distribution of salmonids in the plan area. This new data will improve the accuracy of stream class designations and decrease the risk of potential take of coho salmon from forest management.

MRC uses out-migrant trapping to estimate the number of Central California Coast coho moving from Little North Fork Navarro and South Fork Albion to the ocean. Later in the year, we monitor how many of them return from the ocean to these same rivers to spawn. Over the term of our HCP/NCCP, potential take from out-migrant trapping may result from capturing, anesthetizing, handling, fin clipping, and releasing coho juveniles. Table 12-6 provides an estimate of potential take based on our current permit allowances prior to implementation of our HCP/NCCP. Future projections assume a modest increase in capture rates due to increased levels of monitoring and increases in population size. The estimates in Table 12-6 (row 1) refer to the number of coho juveniles that MRC is legally permitted to temporarily capture for the purposes of monitoring. Incidental mortality of juveniles from such capture must not exceed 2% of this number. Occasionally, adult coho are incidentally caught in an out-migrant trap. The estimates in Table 12-6 (row 2) show the potential number of coho adults that might be caught in a trap and released throughout the term of the HCP/NCCP.

Table 12-6 Coho Salmon—Central California Coast (CCC)

Potential Take from Out-migrant Trapping of Adult and Juvenile Stages of Coho Salmon (CCC)											
Little North Fork Navarro and South Fork Albion											
Species	**ESU**	**Pre-NCCP/HCP**	**Years Post HCP/NCCP Implementation**								
			10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**Total**
Coho Salmon (juvenile)	CCC	45,000*	45,000	45,000	50,000	50,000	55,000	55,000	60,000	60,000	420,000
Coho Salmon (adult)	CCC	0**	20	20	20	20	20	20	30	30	180
Totals		45,000	45,020	45,020	50,020	50,020	55,020	55,020	60,030	60,030	420,180

TABLE NOTES
* Denotes current allowed annual take for pre-HCP/NCCP monitoring and research multiplied by 10 years for comparison.
**Denotes adult life stages incidentally captured. Pre-HCP/NCCP numbers are based on actual data (averages) multiplied by 10 years for comparison.

Table 12-7 provides an estimate of potential take from Annual Salmonid Monitoring Basins (M§13.6.1.1-1) and Anadromous Salmonid Distribution monitoring (M§13.6.1.1-2). The estimate of potential take is based on our current permit allowances prior to implementation of our HCP/NCCP. Potential take may result from capturing, anesthetizing, handling, and releasing coho juveniles. Based on the number of survey sites (roughly 500 survey sites maximum per year) and the tendency to avoid harassment (by ceasing surveys after MRC staff detect 1 individual of each species), the current take allotment would be sufficient throughout the term of our HCP/NCCP. If populations expand and our ability to detect salmonid species improves over time, the overall take of covered salmonids due to monitoring may actually decline, based on proposed non-invasive sampling.

Table 12-7 Coho Salmon – SONCC and CCC

Potential Take from ASMB and Salmonid Distribution Monitoring of Coho Salmon (SONCC and CC) Juvenile Life Stages											
Species	**ESU**	**Pre-NCCP/HCP**	**Years Post HCP/NCCP Implementation**								
			10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**Total**
Coho Salmon (juveniles)	SONCC	10,000*	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	80,000
Coho Salmon (juveniles)	CCC	10,000*	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	80,000
Total		20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	160,000

TABLE NOTES
* Denotes current allowed take for pre-HCP/NCCP monitoring and research multiplied by 10 years for comparison.

Fine sediment delivery from MRC covered activities will continue to impair the emergence success of coho fry, but at a lesser rate than currently experienced. As a result of HCP/NCCP improvements in gravel permeability, pool quantity, and pool quality, we expect increases in coho egg survival-to-emergence and juvenile abundance.

Migration barriers due to stream crossings will continue under HCP/NCCP implementation. However, MRC will decommission roads and remove stream crossings. Decommissioning roads will decrease sediment delivery to streams and removal of stream crossings will facilitate increased migration.

12.3.2 Chinook salmon

12.3.2.1 Location and distribution in the plan area

Chapter 4 (section 4.3) provides a detailed species account of Chinook salmon, including geographic distribution, local distribution in the plan area, population trends, life history, and habitat requirements.

12.3.2.2 Suitable habitat in the plan area

Table 3-8 provides historical data on aquatic habitat conditions for major streams and rivers in the plan area from 1998 to 2008. This data is the basis for designating *potential suitable habitat* for Chinook salmon. This potential suitable habitat includes all Class I streams and associated riparian habitat within a 300-ft wide AMZ (150 ft on either bank) up to the natural limit of anadromy (i.e., the most downstream naturally-occurring fish passage barrier) where there is documented historical occurrence of Chinook salmon.

For California Coastal fall-run Chinook salmon, a combined total of 203 stream miles and 25,162.9 ac of known occupied and potential suitable habitat may be present in the plan area (Table 12-10). MRC assumes that suitable habitat for Chinook salmon is in the creek reaches that historically supported the species or currently do so.

12.3.2.3 Covered activities adjacent to suitable habitat

Chinook salmon depend on the condition of surrounding forests and rangelands. The condition of the watersheds that drain these forests and rangelands controls the physical structure and chemical composition of the streams in which fish migrate, spawn, and rear. While there have been many studies on the effects of land use, including forest management, on aquatic ecosystems, the relationships between land use and stream productivity are complex.

MRC covered activities with the most potential to adversely affect Chinook salmon and their habitat are

- Timber harvest (harvesting, yarding, loading, and hauling).
- Construction, reconstruction, and maintenance of landings and skid trails.
- Construction and maintenance of roads.
- Construction and maintenance of stream crossings and culverts.

These activities can (a) alter natural hydrology; (b) lead to an increase in sediment input and turbidity; (c) reduce stream bank stability and input of LWD to streams; (d) reduce stream shade and floodplain connectivity; and (e) degrade water quality.

Changes to the distribution of precipitation reaching the ground, evaporation rates, the amount of precipitation intercepted by vegetation, and the amount of precipitation stored in the soil may impact runoff (Meehan 1991). Changes in natural flow regimes may, in turn, impact Chinook salmon. The timing and magnitude of stream flows, for example, provide the environmental cues for adult and juvenile migrations. This timing may cause dewatering of redds, displacement of fry or juveniles, or scouring of spawning gravels. Because juvenile Chinook salmon typically emigrate to the ocean before summer, potential changes to summer flows tend to have minimal effect on the productivity of Chinook salmon.

Timber operations and road construction or maintenance that results in ground-disturbance could alter the rate and pathways of water movement resulting in erosion, road failures, landslides, sediment transport, and ultimately delivery to streams. Increases in sedimentation and turbidity affect fish physiology, behavior, and habitat. Physiological effects of turbidity on salmonids include gill trauma, altered blood sugar levels, and osmoregulatory function. Behavioral effects include avoidance of high turbidity, changes in foraging ability, increased predation risk, and reduced territoriality. Fine sediment may reduce salmonid spawning and rearing habitat quality and quantity. Deposition of excessive fine sediment on the stream bottom could (a) eliminate habitat for aquatic insects; (b) reduce density, biomass, number, and diversity of aquatic insects and vegetation; (c) reduce permeability of spawning gravel; and (d) block the interchange of surface and subsurface waters. Increases in fine sediments in low velocity stream reaches could also cover spawning gravel or reduce the number, volume, and depth of pools. Existing and future road crossings can result in the creation of barriers to fish migration. Barriers could reduce the amount of available habitat for spawning and rearing, and lead to increases in predation of adults.

Substantial sediment input and deposition could (a) cause channel braiding; (b) increase width-to-depth ratios; (c) increase incidence and severity of bank erosion; (d) reduce pool volume and frequency; and (e) increase subsurface flow. In general, these actions tend to reduce habitat values by reducing the structural and hydraulic complexity of natural channels and preventing channel processes that sustain these values.

Despite conservation measures in place to reduce sediment inputs (section 8.3.3), harm to Chinook salmon will still occur under our HCP/NCCP; local habitat conditions will continue to impair the ability of individual fish to grow, rear, migrate, or spawn. However, MRC will substantially reduce sediment delivery within the plan area by (a) reducing the potential for mass wasting; (b) upgrading the road network; (c) decommissioning roads; (d) applying stringent conditions to the development of new roads; and (e) designating 50% of our road network to temporary use. All of these actions will reduce impacts to Chinook salmon and improve habitat conditions which currently may impair the survival rates of Chinook eggs and juveniles. Through monitoring and adaptive management, MRC will ensure, at a minimum, that

- Stream gravel permeability will, on average, approach or exceed 10,000 cm/hr across stream reaches.

- Percent of fine material < 0.85 mm will, on average, approach < 7% across stream reaches (using dry sieve techniques).
- Proportion of fine sediment in pools will, on average, approach < .21 across stream reaches (using V-Star methodology).

The removal of streamside vegetation during timber operations and road construction can reduce the number of trees available for recruitment to streams and affect the coverage and health of vegetation. Vegetation provides structural stability to stream banks. A reduction in vegetation could lead to a reduction in structural complexity in channels and cover within streams. Large wood is an important component of salmonid habitat in streams. Canopy removal that increases exposure of streams to solar radiation can increase water temperatures and the magnitude of daily temperature fluctuations. Temperature change can have direct and indirect effects on the growth, survival, and reproduction of fish.

The use of heavy equipment could result in accidental spills or inadvertent discharges of petroleum products (i.e., fuels, lubricants, and hydraulic fluids). The spill or accidental discharge of these materials adjacent to, or in a water body, could potentially affect the water quality of a stream, river, or wetland and thereby directly affect fish or their prey.

Water drafting has the potential to adversely affect Chinook salmon through (a) excessive withdrawal rates that reduce available water; (b) high intake velocities that entrain fish; and (c) inadequately-sized intake screens that allow fish to pass through. Withdrawing water from Class I streams with Chinook salmon present from April 1 to November 15 could interrupt juvenile migration and reduce juvenile rearing habitat for up to 24 hours, depending on the water recovery rate.

Other covered activities with the potential to adversely affect Chinook salmon include stream habitat improvement, as well as research and monitoring activities. Habitat improvement can lead to short-term increases in turbidity and sedimentation. However, the magnitude of these effects would be much less than those incurred with timber operations. Moreover, habitat improvement would ultimately benefit fish.

Research and monitoring activities could result in direct and indirect effects on fish. Fish surveys requiring the capture or handling of fish (e.g., electrofishing, trapping, and netting) may affect the growth or survival of juvenile Chinook salmon. Stream surveys could interfere with migration and spawning of fish; they could also result in the crushing and trampling of eggs in redds. Moreover, improper stream classification could trigger reduced protections to stream reaches (e.g., reduced buffer widths), thereby adversely impacting fish.

12.3.2.4 Mitigation that offsets the effects of forest management

MRC protects and conserves all 3 covered salmonids (coho salmon, Chinook salmon, and steelhead) and their respective life stages by focusing on their aquatic habitat. We have adopted standard conservation measures for all Class I streams because all salmonid life stages may be present in all fish-bearing streams at any time. AMZs support, in one way or another, the unique habitat requirements of each of the salmonid species. Our approach avoids the problems of single-species management. Overall, the MRC conservation measures include

- Stream buffers.
- Improvements to riparian areas and enhancement of riparian functions.
- Equipment exclusion zones and restricted harvest in AMZs.
- Reduction of sediment input to streams from roads and timber harvests.

- Monitoring stream flows during water drafting.
- Culvert upgrades.
- Stream habitat enhancement.
- Monitoring surveys.

Combined, these measures will reduce sediment input to streams, avoid creating barriers to fish migration, and enhance riparian function while at the same time minimizing impacts in AMZs. All this, along with the protections for coho salmon and steelhead, will ensure that take of California Coastal fall-run Chinook salmon is also minimized or avoided. In addition, the proposed and ongoing survey and monitoring efforts will ensure that MRC identifies occupied and suitable habitat for fall-run Chinook salmon.

12.3.2.5 Level of expected take

MRC conservation measures should minimize the incidental take of California Coastal Chinook salmon because they protect (a) water quality (e.g., from turbidity, increased water temperature, and pollutants); (b) spawning substrate (e.g., by avoidance or reduction in sediment loading); and (c) habitat complexity (e.g., through bank stability, increased pool depth, improved riparian function, and recruitment of LWD). In addition, implementation of habitat improvements, such as replacement of instream structures, channel realignment, and bedload reduction should benefit Chinook salmon, especially in areas that have not yet recovered from the impacts of historical logging practices.

If MRC does not accurately designate stream classes, this could result in reduced protection and habitat quality for Chinook. However, we believe this potential risk of take resulting from inaccurate designation of stream classes is low because MRC will ensure accurate classification of stream channels and identification of key habitat through watershed analysis, biological monitoring (fish and habitat surveys), and other related riparian strategies.

Some direct take of California Coastal Chinook salmon may occur as a result of water drafting. For Chinook salmon, there are 7 water drafting sites in Hollow Tree Creek and the Albion River (*HCP/NCCP Information Atlas*, MAPS 24A-B). We classified 6 sites as recovering fast (in less than 6 hours) and 1 site as slow to recover (in 24 hours). However, we identify these sites based on habitat present, not current distribution. Impacts from water drafting on Chinook would not be as great as on coho or steelhead. To minimize impacts to Chinook salmon, we propose measures similar to those for coho salmon. The amount of take of Chinook salmon would be less than coho salmon because of their limited habitat in the plan area and the timing of their spawning and juvenile migration; Chinook leave the streams for more estuarine habitat early in the spring when MRC is typically not water drafting. Some take may occur as a result of water drafting activities, but we cannot quantify the take.

Research and monitoring activities, such as fish distribution and abundance monitoring as well as fish habitat surveys, could result in harm to individual salmonids. This could stem from capture, handling, and subsequent interference with feeding, migration, or spawning. Electrofishing and out-migrant trapping would have the greatest potential for harm. However, MRC will reduce the potential for mortality of individuals by only using electrofishing when water temperatures are 18 degrees C or less. Moreover, MRC research will increase information about the distribution of salmonids in the plan area. This data will improve the accuracy of stream class designations and decrease the risk of potential take of Chinook salmon from forest management.

Table 12-8 provides an estimate of potential take of California Coastal Chinook salmon from out-migrant trapping. Potential take could be due to capturing, anesthetizing, handling, and releasing Chinook juveniles. Currently Chinook salmon are not included in the MRC permit for out-migrant trapping because, so far, we have not confirmed their presence at the trapping locations in Little North Fork Navarro or South Fork Albion. If they do occur during the permit term, the numbers stated should remain accurate given the episodic nature of the species. Of the two locations, Chinook are most likely to occur in South Fork Albion.

Table 12-8 California Coastal (CC) Chinook Salmon

Potential Take from Out-migrant Trapping of California Coastal (CC) Chinook Salmon											
Little North Fork Navarro and South Fork Albion											
Species	**ESU**	**Pre-NCCP/HCP**	**Years Post HCP/NCCP Implementation**								
			10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**Total**
Chinook Salmon	CC	0*	500	1000	1000	1000	1500	1500	1500	2000	10,000
TABLE NOTES * Denotes current allowed annual take for pre-HCP/NCCP monitoring and research multiplied by 10 years for comparison.											

Table 12-9 provides an estimate of potential take from Annual Salmonid Monitoring Basins (M§13.6.1.1-1), Chinook Salmon Monitoring Reaches (M§13.6.1.1-3), and Anadromous Salmonid Distribution monitoring (M§13.6.1.1-2).

Table 12-9 California Coastal (CC) Chinook Salmon

Potential Take from ASMB, CSMR, and Salmonid Distribution Monitoring of Chinook (CC) Juvenile Life Stages											
Species	**ESU**	**Pre-NCCP/HCP**	**Years Post HCP/NCCP Implementation**								
			10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**Total**
Chinook Salmon **	CC	100*	2000	2000	3000	3000	4000	4000	5000	5000	28,000
TABLE NOTES * Current allowed take for pre-HCP/NCCP monitoring and research multiplied by 10 years. **Categories for proposed snorkel surveys for Chinook salmon are (a) observe or harass and (b) no capture.											

MRC cannot precisely determine the number of covered salmonids that will be harmed or harassed during our forest management activities. We have chosen to use management disturbance within 150 ft of Class I streams as a surrogate for such harm or harassment. Harm to covered species may result from degradation to aquatic habitat (e.g., harvested acres, loss of LWD recruitment, and sediment inputs) and harassment from elevated levels of turbidity in the streams, as well as other factors. Covered activities could impact 10 to 1056 ac per decade of riparian habitat in the California Coastal Chinook salmon ESU (Table 12-10). Over the course of the permit term, covered activities could impact up to 12,393 ac of riparian habitat for that ESU (Table 12-10). However, our conservation measures will ensure higher densities of larger trees in Class I streams which in turn will provide higher rates of LWD recruitment and water quality benefits. If MRC conservation measures prove to be unsuccessful, take of an undetermined number of Southern Oregon/Northern California Coast coho salmon and Central Coast coho salmon could result. However, we do not expect them to be unsuccessful. Instead we anticipate that our conservation measures will improve the aquatic habitat for all life stages of salmonids.

All Chinook salmon in the plan area are in Class I streams (i.e., fish bearing streams). MRC estimates that there are 409.5 miles of Class I streams within the plan area (see *HCP/NCCP Atlas*, MAPS 18A-C). The total length of Class I streams for watersheds where Chinook salmon could potentially occur is 110.6 miles (Table 12-10).

Table 12-10 California Coastal (CC) Chinook Salmon

California Coastal Chinook Salmon										
Total Stream Miles, Habitat Acres, and Habitat Harvested										
WAU	**Miles of Class I Streams**	**Total Acres of Class I Habitat (AMZs)**	**Potential Acres Harvested Within Class I Habitat By Decade**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
*Hollow Tree Creek	44.8	5,578.42	-	-	57	251	673	748	861	788
*Noyo River	34.8	4,510.82	-	24	86	186	252	418	520	565
Big River	71.8	8,500.61	-	10	191	387	350	732	904	1,056
*Albion River	31	3,955.54	21	55	113	225	357	464	486	501
Garcia River	20.8	2,617.51	17	50	78	133	132	222	210	270
WAU Total	203.2	25,162.90	38	139	525	1182	1764	2584	2981	3180
* WAU Total	**110.6**	**14,044.78**	****Total Acres Harvested = 12,393**							

TABLE NOTES

* Indicates a known occurrence of the species. The species may not currently occupy all Class I streams in the watershed.

** This is the total number of acres harvested by decade and can include areas previously harvested. Because of this overlap, the actual amount of harvested habitat may be less than the estimate.

Fine sediment delivery from covered activities will continue to impair the emergence success of Chinook fry, but at a lesser rate than currently experienced. As a result of HCP/NCCP improvements in gravel permeability, pool quantity, and pool quality, we expect increases in coho egg survival-to-emergence and juvenile abundance.

Migration barriers due to stream crossings will continue under HCP/NCCP implementation. However, MRC will decommission roads and remove stream crossings. Decommissioning roads will decrease sediment delivery to streams and removal of stream crossings will facilitate increased migration.

12.3.3 Steelhead

12.3.3.1 Location and distribution in the plan area

Chapter 4 (section 4.4) provides a detailed species account of steelhead, including geographic distribution, local distribution in the plan area, population trends, life history, and habitat requirements.

12.3.3.2 Suitable habitat in the plan area

Table 3-8 provides historical data on aquatic habitat conditions for major streams and rivers in the plan area from 1998 to 2008. For purposes of this analysis, potential suitable habitat for steelhead includes all Class I streams within the plan area and associated riparian habitat up to the natural limit of anadromy (i.e., the most downstream naturally-occurring fish passage barrier).

For Northern California steelhead, a total of 401 stream miles and 49,902.77 ac of known occupied and potential suitable habitat may be present in the plan area (Table 12-14); likewise, for Central California Coast steelhead, a total of 8.5 stream miles and 1004.10 ac (Table 12-15).

12.3.3.3 Covered activities adjacent to suitable habitat

Steelhead trout depend on the condition of surrounding forests and rangelands. The condition of the watersheds that drain these forests and rangelands controls the physical structure and chemical composition of the streams in which fish migrate, spawn, and rear. While there have been many studies on the effects of land use, including forest management, on aquatic ecosystems, the relationships between land use and stream productivity are complex.

MRC covered activities with the most potential to adversely affect steelhead trout and their habitat are

- Timber harvest (harvesting, yarding, loading, and hauling).
- Construction, reconstruction, and maintenance of landings and skid trails.
- Construction and maintenance of roads.
- Construction and maintenance of stream crossings and culverts.

These activities can alter natural hydrology; lead to an increase in sediment input and turbidity; reduce stream bank stability and input of LWD to streams; reduce stream shade and floodplain connectivity; and degrade water quality.

Changes to the distribution of precipitation reaching the ground, evaporation rates, the amount of precipitation intercepted by vegetation, and the amount of precipitation stored in the soil may impact runoff (Meehan 1991). Changes in natural flow regimes may, in turn, impact steelhead trout. The timing and magnitude of stream flows, for example, provide the environmental cues for adult and juvenile migrations. This timing may cause dewatering of redds, displacement of fry or juveniles, or scouring of spawning gravels. Because juvenile steelhead trout typically emigrate to the ocean before summer, potential changes to summer flows tend to have minimal effect on the productivity of steelhead.

Timber operations and road construction or maintenance that results in ground-disturbance could alter the rate and pathways of water movement resulting in erosion, road failures, landslides, sediment transport, and ultimately delivery to streams. Increases in sedimentation and turbidity affect fish physiology, behavior, and habitat. Physiological effects of turbidity on salmonids include gill trauma, altered blood sugar levels, and osmoregulatory function. Behavioral effects include avoidance of high turbidity, changes in foraging ability, increased predation risk, and reduced territoriality. Fine sediment may reduce salmonid spawning and rearing habitat quality and quantity. Deposition of excessive fine sediment on the stream bottom could eliminate habitat for aquatic insects; reduce density, biomass, number, and diversity of aquatic insects and vegetation; reduce permeability of spawning gravel; and block the interchange of surface and subsurface waters. Increases in fine sediments in low velocity stream reaches could also cover spawning gravel or reduce the number, volume, and depth of pools. Existing and future road crossings can result in the creation of barriers to fish migration. Barriers could reduce the amount of available habitat for spawning and rearing; this might lead to increases in predation of adults.

Substantial sediment input and deposition could (a) cause channel braiding; (b) increase width-to-depth ratios; (c) increase incidence and severity of bank erosion; (d) reduce pool volume and frequency; and (e) increase subsurface flow. In general, these actions tend to reduce habitat values by diminishing the structural and hydraulic complexity of natural channels and preventing channel processes that sustain these values.

Despite conservation measures in place to reduce sediment inputs (section 8.3.3), harm to steelhead will still occur under our HCP/NCCP; local habitat conditions will continue to impair the ability of individual fish to grow, rear, migrate, or spawn. However, MRC will substantially reduce sediment delivery within the plan area by (a) reducing the potential for mass wasting; (b) upgrading the road network; (c) decommissioning roads; (d) applying stringent conditions to the development of new roads; and (e) designating 50% of our road network to temporary use. All of these actions will reduce impacts to steelhead and improve habitat conditions which currently may impair the survival rates of steelhead eggs and juveniles. Through monitoring and adaptive management, MRC will ensure, at a minimum, that

- Stream gravel permeability will, on average, approach or exceed 10,000 cm/hr across stream reaches.
- Percent of fine material < 0.85 mm will, on average, approach < 7% across stream reaches (using dry sieve techniques).
- Proportion of fine sediment in pools will, on average, approach < .21 across stream reaches (using V-Star methodology).

The removal of streamside vegetation during timber operations and road construction can reduce the number of trees available for recruitment to streams and affect the coverage and health of vegetation. Vegetation provides structural stability to stream banks. A reduction in vegetation could diminish structural complexity in channels and cover within streams. Large wood is an important component of salmonid habitat in streams. Canopy removal that increases exposure of streams to solar radiation can increase water temperatures and the magnitude of daily temperature fluctuations. Temperature change can have direct and indirect effects on the growth, survival, and reproduction of fish.

The use of heavy equipment could result in accidental spills or inadvertent discharges of petroleum products (i.e., fuels, lubricants, and hydraulic fluids). The spill or accidental discharge of these materials adjacent to, or in a water body, could potentially affect the water quality of a stream, river, or wetland and thereby directly affect fish or their prey.

Juvenile Steelhead

Water drafting has the potential to adversely affect steelhead through (a) excessive withdrawal rates that reduce available water; (b) high intake velocities that entrain fish; and (c) inadequately-sized intake screens that allow fish to pass through. Withdrawing water from Class I and Class II streams with steelhead present from April 1 to November 15 could

- Interrupt juvenile rearing and smolt migration.
- Dewater redds.
- Reduce habitat for up to 24 hours, depending on the water recovery rate.

Other covered activities with the potential to adversely affect steelhead include stream habitat improvement, as well as research and monitoring activities. Habitat improvement can lead to short-term increases in turbidity and sedimentation. However, the magnitude of these effects would be much less than those incurred with timber operations. Moreover, habitat improvement would ultimately benefit fish.

Research and monitoring activities could result in direct and indirect effects on fish. Fish surveys requiring the capture or handling of fish (e.g., electrofishing, trapping, and netting) may affect the growth or survival of juvenile steelhead. Stream surveys could interfere with migration and spawning of fish; they could also result in the crushing and trampling of eggs in redds. Moreover, improper stream classification could trigger reduced protections to stream reaches (e.g., reduced buffer widths), thereby adversely impacting fish.

12.3.3.4 Mitigation that offsets the effects of forest management

MRC protects and conserves all 3 covered salmonids (coho salmon, Chinook salmon, and steelhead) and their respective life stages by focusing on their aquatic habitat. We have adopted standard conservation measures for all Class I streams because all salmonid life stages may be present in all fish-bearing streams at any time. AMZs support, in one way or another, the unique habitat requirements of each of the salmonid species. Our approach avoids the problems of single-species management. Overall, the MRC conservation measures include

- Stream buffers.
- Improvements to riparian areas and enhancement of riparian functions.
- Equipment exclusion zones and restricted harvest in AMZs.
- Reduction of sediment input to streams from roads and timber harvests.
- Monitoring stream flows during water drafting.
- Culvert upgrades.
- Stream habitat enhancement.
- Monitoring surveys.

Combined, these measures will reduce sediment input to streams, avoid creating barriers to fish migration, and enhance riparian function while at the same time minimizing impacts in AMZs. All this, along with the protections for coho salmon and Chinook salmon, will ensure that take of Northern California and Central California Coast steelhead is also minimized or avoided. In addition, the proposed and ongoing survey and monitoring efforts will ensure that MRC identifies occupied and suitable habitat for steelhead. If future surveys result in the designation of additional Class I streams, or determine new reaches where suitable habitat for steehead exist, MRC will afford these streams and reaches the conservation measures adopted for the 3 covered salmonids.

12.3.3.5 Level of expected take

MRC conservation measures should minimize the incidental take of Northern California and Central California Coast steelhead because they protect (a) water quality (e.g., from turbidity, increased water temperature, and pollutants); (b) spawning substrate (e.g., by avoidance or reduction in sediment loading); and (c) habitat complexity (e.g., through bank stability, increased pool depth, improved riparian function, and recruitment of LWD). In addition, implementation of habitat improvements, such as replacement of instream structures, channel realignment, and bedload reduction should benefit steelhead trout, especially in areas that have not yet recovered from the impacts of historical logging practices.

If MRC does not accurately designate stream classes, this could result in reduced protection and habitat quality for steelhead. However, we believe this potential risk of take resulting from inaccurate designation of stream classes is low because MRC will ensure accurate classification of stream channels and identification of key habitat through watershed analysis, biological monitoring (fish and habitat surveys), and other related riparian strategies.

Some direct take of Northern California and Central California Coast steelhead may occur as a result of water drafting. In the plan area, there are a total of 78 water drafting sites in potential steelhead habitat. MRC classified 47 sites as recovering fast (less than 6 hours), 20 sites as recovering slowly (24 hours), and 11 sites as undetermined (*HCP/NCCP Atlas*, MAPS 25A-C). MRC proposes measures to minimize impacts to steelhead similar to those for coho salmon. The take of steelhead may be more than coho salmon because steelhead occurs more widely in the plan area.

In the plan area, the take of steelhead will most likely occur at waterholes when there is a reduction in the flow of water. We decided to capture the effect of drafting both at the waterhole and 200m downstream from the waterhole. In order to quantify take, we averaged the width of drafting holes across the property; this came out to be 4m. We then multiplied the average waterhole width (4m) by the selected downstream length (200m). Fish densities across the plan area vary annually as well as site-to-site. Based on MRC data for the plan area, the average of mid-to-high densities is 1 steelhead/m^2. The amount of waterholes which MRC will use per year will vary depending on the number and location of projects across the plan area. We estimated that in years of heavy activity, we may use approximately 3 sites in the CCC ESU and 10 sites in the NC ESU. Incorporating all this information, the formula for number of CCC steelhead potentially harassed = 1 steelhead/m^2*(4m*200m) *3 sites = 2400 steelhead per year. Similarly, the formula for number of NC steelhead potentially harassed = 1 steelhead/m^2*(4m*200m) *10 sites = 8000 steelhead per year. Table 12-11 shows the potential take of steelhead from water drafting during the 80-year term of the HCP/NCCP.

Table 12-11 Potential Take of Steelhead from Water Drafting

Potential Take of Steelhead During Water Drafting Plan Area								
Decades								
1	2	3	4	5	6	7	8	Total
Central California Coast (CCC) Steelhead								
24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	192,000
Northern California (NC) Steelhead								
80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	640,000

Research and monitoring activities, such as fish distribution and abundance monitoring as well as fish habitat surveys, could result in harm to individual salmonids. This would stem from capture and handling, as well as subsequent interference with feeding, migration, or spawning. Electrofishing and out-migrant trapping would have the greatest potential for harm. However, MRC will reduce the potential for mortality of individuals by only using electrofishing when water temperatures are 18 degrees C or less. Moreover, MRC research will increase information about the distribution of steelhead in the plan area. This data will improve the accuracy of stream class designations and decrease the risk of potential take of steelhead from forest management.

MRC uses out-migrant trapping to estimate the number of Northern California steelhead moving from Little North Fork Navarro and South Fork Albion to the ocean. Later in the year, we monitor how many of them return from the ocean to these same rivers to spawn. Over the term of our HCP/NCCP, potential take from out-migrant trapping may result from capturing, anesthetizing, handling, fin clipping, and releasing steelhead juveniles. Table 12-12 provides an estimate of potential take based on our current permit allowances prior to implementation of our HCP/NCCP. Future projections assume a modest increase in capture rates due to increased levels of monitoring and increases in population size. The estimates in Table 12-12 (row 1) refer to the number of steelhead that MRC is legally permitted to temporarily capture for the purposes of monitoring. Incidental mortality of juveniles from such capture must not exceed 2% of this number. Occasionally, adult steelhead are incidentally caught in an out-migrant trap. The estimates in Table 12-12 (row 2) show the potential number of steelhead adults that might be caught in a trap and released throughout the term of our HCP/NCCP.

Table 12-12 Northern California (NC) Steelhead

Potential Take from Out-migrant Trapping of NC Steelhead (Adult and Juvenile Stages)											
Little North Fork Navarro and South Fork Albion											
Species	**ESU**	**Pre-NCCP/HCP**	**Years Post HCP/NCCP Implementation**								
			10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**Total**
Steelhead	NC	50,000*	50,000	50,000	55,000	55,000	60,000	60,000	65,000	65,000	460,000
Steelhead (adult)	NC	50**	50	50	80	80	100	100	120	120	700
Total			50,050	50,050	55,080	55,080	60,100	60,100	65,120	65,120	460,700

TABLE NOTES
* Denotes current allowed take for pre-HCP/NCCP monitoring and research multiplied by 10 years for comparison
**Denotes adult life stages incidentally captured. Pre-HCP/NCCP numbers are based on actual data (averages) multiplied by 10 years.

Table 12-13 provides an estimate of potential take from Annual Salmonid Monitoring Basins (M§13.6.1.1-1) and Anadromous Salmonid Distribution monitoring (M§13.6.1.1-2). Estimates are based on our current permit allowances prior to implementation of our HCP/NCCP. Potential take may result from capturing, anesthetizing, handling, and releasing steelhead juveniles. Based on the number of survey sites (roughly 500 survey sites maximum per year) and the tendency to avoid harassment (by ceasing surveys after MRC staff detect 1 individual of each species), the current take allotment would be sufficient throughout the term of our HCP/NCCP. If salmonid populations expand and our ability to detect them improves, overall take of covered salmonids due to monitoring may actually decline as we use non-invasive sampling.

Table 12-13 CCC and NC Steelhead

Potential Take from ASMB and Salmonid Distribution Monitoring of Steelhead (CCC and NC) Juvenile Life Stages											
Species	**ESU**	**Pre-NCCP/HCP**	**Years Post HCP/NCCP Implementation**								
			10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**Total**
Steelhead	CCC	2,000*	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	16,000
Steelhead	NC	30,000*	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	240,000
Total			32,000	32,000	32,000	32,000	32,000	32,000	32,000	32,000	256,000

TABLE NOTE
* Current allowed take for pre-HCP/NCCP monitoring and research multiplied by 10 years.

Take may occur in the form of acreage disturbance and harvest within the 150-ft wide buffers along Class I streams. MRC covered activities could impact 83 to 6242 ac per decade of riparian habitat of Northern California steelhead (Table 12-14). Over the course of the permit term, MRC covered activities could impact up to 25,243 ac of riparian habitat for the Northern California steelhead (Table 12-14). During that same time period, MRC covered activities could impact up to 2 ac of the riparian habitat for the Central California Coast steelhead (Table 12-15). However, MRC conservation measures will ensure higher densities of larger trees in Class I streams which in turn will provide higher rates of LWD recruitment and water quality benefits. If MRC conservation measures prove to be unsuccessful, an undetermined number of Northern California steelhead and Central California Coast steelhead would be taken.

All steelhead in the plan area are found in Class I Streams (i.e., fish-bearing streams). MRC estimates that there are 409.5 miles of Class I streams within the plan area (see *HCP/NCCP Atlas*, MAPS 19A-C). The total length of Class I streams for watersheds where Northern California steelhead are known to occur is 401 miles (Table 12-14); for Central California Coast steelhead, 8.5 miles (Table 12-15).

Table 12-14 Northern California (NC) Steelhead

Total Stream Miles, Habitat Acres, and Habitat Harvested in the Plan Area for Northern California Steelhead										
WAU	**Miles of Class I Streams**	**Total Acres of Class I Habitat (AMZs)**	**Potential Acres Harvested Within Class I Habitat By Decade**							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
*Albion River	31	3,955.54	21	55	113	225	357	464	486	501
*Alder Creek/Schooner Gulch	21.2	2,725.88	-	-	104	259	296	419	351	435
*Big River	71.8	8,500.61	-	10	191	387	350	732	904	1,056
*Cottaneva Creek	12.8	1,607.49	-	-	16	59	194	132	242	151
*Elk Creek	20.3	2,394.51	5	10	144	343	453	417	487	428
*Garcia River	20.8	2,617.51	17	50	78	133	132	222	210	270
*Greenwood Creek	19.9	2,490.81	-	-	196	173	321	227	355	250
*Hollow Tree Creek	44.8	5,578.42	-	-	57	251	673	748	861	788
*Navarro River	106.3	13,422.42	40	81	336	550	834	1,174	1,138	1,464
*Noyo River	34.8	4,510.82	-	24	86	186	252	418	520	565
*Rockport Small Coastal Streams	17.3	2,098.76	-	-	-	-	81	168	183	334
TOTAL	**401.0**	**49,902.77**	83	230	1321	2566	3943	5121	5737	6242
			****Total Acres Harvested = 25,243**							

TABLE NOTES
* Indicates a known occurrence of the species. The species may not currently occupy all Class I streams in the watershed.
** Total Acres Harvested is the total number of acres harvested by decade and can include the same areas previously harvested. Because of this overlap, the actual amount of harvested habitat may be less than the estimate.

Table 12-15 Central California Coast (CCC) Steelhead

Total Stream Miles, Habitat Acres, and Habitat Harvested in the Plan Area for Central California Coast Steelhead										
			Potential Acres Harvested Within Class I Habitat							
			By Decade							
WAU	Miles of Class I Streams	Total Acres of Class I Habitat (AMZs)	1	2	3	4	5	6	7	8
*Upper Russian River	8.5	1004.10	-	-	-	-	-	-	-	2
TOTAL	**8.50**	**1004.10**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
			Total Acres Harvested = 2							

TABLE NOTE
* Indicates a known occurrence of the species. The species may not currently occupy all Class I streams in the watershed.

Fine sediment delivery from MRC covered activities will continue to impair the emergence success of steelhead fry, but at a lesser rate than currently experienced. As a result of HCP/NCCP improvements in gravel permeability, pool quantity, and poor quality, we expect increases in steelhead egg survival-to-emergence and juvenile abundance.

Migration barriers due to stream crossings will continue under HCP/NCCP implementation. However, MRC will decommission roads and remove stream crossings. Decommissioning roads will decrease sediment delivery to streams and removal of stream crossings will facilitate increased migration. Table 12-13 indicates that 2000 Central California Coast steelhead juveniles may be taken per decade from annual surveys. This number may also apply to new stream crossings.

12.3.4 Red-legged frog

12.3.4.1 Location and distribution in the plan area

Chapter 4 (section 4.5) provides a detailed species account of the northern and California red-legged frog, including geographic distribution, local distribution in the plan area, population trends, life history, and habitat requirements.

12.3.4.2 Suitable breeding habitat in the plan area

Section 4.5.7 details the requirements, summarized here, for red-legged frog habitat. Northern red-legged frogs use a variety of habitat types: aquatic sites for breeding; riparian and mesic upland forests during the post-breeding season; and upland habitats during overwintering at low elevations (Gomez and Anthony 1996, Nussbaum et al. 1983, Licht 1969).

Red-legged frogs are associated with deep pool habitat. Licht (1969) reported that northern red-legged frogs usually call underwater from a depth of at least 92 cm (3 ft). Hayes and Jennings (1988) found California red-legged frogs in Central Valley drainages almost exclusively (99%) at sites with some water at least 70 cm (27.5 in) deep.

Red-legged frogs breed in coastal lagoons, permanent or temporary pools, marshes, ponds or backwater portions of permanent or intermittent streams, and artificial impoundments (Stebbins 1985, Jennings and Hayes 1994, USFWS 1997a). Larval red-legged frogs use both mud and vegetation for cover (Calef 1973, as cited in USFWS 1980). Optimal habitat includes emergent willow, stems, grasses, cattails, submerged weed stems, and filamentous algae (Wiens 1970).

Metamorphosed red-legged frogs may be found far from water during the non-breeding season, particularly in moist or humid habitats (Nussbaum et al. 1983). During the non-breeding season, California red-legged frogs reportedly use small mammal burrows and moist leaf litter up to 25.9 m (85 ft) from water in dense riparian vegetation for estivation (USFWS 1997a).

Haggard (2000) found that the average distance that northern red-legged frogs moved from their breeding sites was 149 m. Recent movement studies indicate that the percentage of California red-legged frogs moving away from breeding habitat varies; 66% of females and 25% of males dispersed in one study (Fellers and Kleeman 2007) while less than 50% in another (Tartarian 2008). Bulger et al. (2003) found that 90% of non-dispersing California red-legged frogs stayed within 60 m of their aquatic sites, with a maximum distance of up to 130 m recorded after summer rain. Fellers and Kleeman (2007) found that the median distance California red-legged frogs dispersed was 150 m, generally moving to the nearest available non-breeding habitat. Dispersing frogs can move great distances, with 1 record of a 2.8 km straight-line map distance in a single season (Bulger et al. 2003).

There are a total of 11 sites where red-legged frogs are known to occur in the plan area, based on both surveys and incidental observations. Survey data collected for these sites included water temperature, canopy cover, and maximum water depth. Temperatures at known locations ranged from 8.3^{o} C to 14.5^{o} C (46.9^{o} F to 58.1^{o} F), with an average temperature of 10.5^{o} C (50.9^{o} F). Canopy closure ranged from 0% to 60%, with 9 sites having canopy coverage of 25% or less. Average canopy cover of occupied sites was 21%. Ten occupied sites had a maximum water depth of at least 3 ft, with 5 sites having a maximum depth of at least 6 ft.

MRC has not mapped all potential breeding habitat for red-legged frogs; we have defined criteria for mapping sites based on depth and persistence of water (Table 10-2). Within the plan area, wetland habitat is most likely to be found adjacent to larger stream classes. The definition of potentially suitable habitat, for the purposes of this analysis, is all Class I and Large Class II streams, as well as the area within 150 m of these streams. The basis for this definition is (a) known habitat associations of red-legged frogs; (b) the probability that breeding habitat would be located within riparian areas of larger streams; and (c) the recognition that there has been incomplete mapping of potential breeding habitat in the plan area. This definition should encompass the majority of potential habitat but is also likely to greatly overestimate the amount of habitat available in the plan area because it assumes that suitable breeding is evenly distributed in all Class I and Large Class II streams, which is unlikely. Suitable breeding habitat is likely to be more unevenly (or “patchily”) distributed but still associated with Class I and Large Class II streams. Based on this analysis, Table 12-16 shows the amount of suitable habitat available in the plan area. Since red-legged frogs are not likely to use all Class I and Large Class II streams and all ponds, and most red-legged frogs move less than 150 m from aquatic habitats, these habitat estimates are overstated.

Table 12-16 RLF Habitat

Red-legged Frog Suitable Habitat in Plan Area	
Inventory Block	**Acres**
Albion	4797
Big River	10,997
Garcia River	4603
Navarro East	9172
Navarro West	7683
Noyo	5462
Rockport	11.576
South Coast	10.991
Ukiah	1367
Total	**66,626**

12.3.4.2.1 Covered activities adjacent to suitable habitat

Covered activities that are likely to occur in or adjacent to occupied or suitable habitat during the permit term primarily include (a) timber management; (b) road construction, reconstruction, maintenance, and use; (c) research and monitoring; and (d) heavy equipment use in ELZs.

Timber management includes timber harvest operations and silvicultural activities. Timber harvest operations include harvesting, yarding, loading, and hauling timber. Silvicultural activities include stand improvement and regeneration, specifically tree planting, seeding, site preparation, brush removal, broadcast burning, and fire control. Road construction, reconstruction, maintenance, and use includes (a) construction, reconstruction, and maintenance of roads, landings, and skid trails; (b) closure of both temporary and permanent roads and skid trails; (c) construction and maintenance of stream crossings; (d) water drafting; (e) development and use of rock pits; (f) maintenance and fueling of equipment; and (g) use of roads by outside parties under right-of-way agreements. Research and monitoring include fish and fish habitat sampling, amphibian surveys, and distribution and abundance monitoring.

Timber management activities, particularly canopy removal, can decrease shading and cause changes to microclimates in the aquatic and riparian areas. Microclimate changes include water temperature, water temperature fluctuation, humidity, and wind velocity (Ledwith 1996; Chen et al. 1995, 1999). Increased stream temperatures can affect reproduction and development or survival of embryonic and larval stages (Licht 1971, Nussbaum et al. 1983). Removal of riparian vegetation can cause a decrease in humidity in riparian zones, due to increased sunlight and wind. This can affect survival of frogs because they rely on high humidity levels and low wind velocity to prevent dehydration and allow respiratory functions. Modification of riparian canopy could result in a change in riparian plant species which in turn could alter the composition and production of algae. This could result in the alteration of food sources available to tadpoles and, potentially, adult red-legged frogs. Timber management activities in riparian habitat could also lead to direct mortality of individuals from crushing by equipment, falling trees, or humans walking through the area.

By reducing the number of recruitment trees available, timber management and road-related activities within a riparian area can result in a decrease in the amount of LWD in a stream (Bryant 1980, Andrus et al. 1988, Murphy and Koski 1989, Ralph et al. 1994) or cause a change in the timing of LWD input (Reid and Hilton 1998). Decreased LWD levels can reduce structural complexity and pool habitat (Keller and Swanson 1979, Sullivan et al. 1987, Montgomery et al.

1995, Beechie and Sibley 1997, Dominguez and Cederholm 2000). This could lead to a decrease in survival of red-legged frogs that use LWD and deep pools for cover (Licht 1969, Gregory 1979, as cited in Davidson 1993).

Timber management and road-related activities can also result in an increase in fine sediment in streams and ponds (Furniss et al. 1991). This could (a) interfere with attachment of eggs to substrates; (b) adversely affect embryo development; (c) reduce production of algae and macroinvertebrates; (d) reduce foraging success; and (e) cause direct mortality. Embryonic and tadpole stages would be most affected.
Timber management and road-related activities can reduce streambank stability; this could result in increases in fine sediment in the stream and a loss of streambank features used by amphibians for cover (FEMAT 1993, Sedell and Bescheta 1991, Swanson et al. 1982). This, in turn, could lead to a reduction in the amount of breeding and foraging habitat available and could decrease the survival, foraging, and reproductive success of red-legged frogs. Equipment and vehicles operating in riparian areas increase the risk of gas and oil pollution, which could harm or kill frogs.

Vegetation removal can (a) influence the hydrology of wetlands, seeps, and springs; (b) change vegetation abundance and diversity; and (c) affect physical attributes such as shade, microclimate, prey availability, and cover. This could reduce habitat quality for red-legged frogs.

Timber management activities can create barriers to movement. Practices such as removal of understory vegetation, removal of downed wood, and even-aged stand management can fragment habitats, creating physical barriers to movement. This could decrease the ability of red-legged frogs to move between metapopulations across the landscape and to access upland habitat during the non-breeding season, leading to an overall decrease in survival and breeding success (Welsh et al. 1998).

Broadcast burning, changes in hydrology, and wildlife or fish surveys could also impact red-legged frogs. Broadcast burning could cause direct mortality to red-legged frogs and could affect their habitat by eliminating downed wood, decreasing canopy cover and structural complexity, increasing delivery of fine sediment to water bodies, and changing microclimates. Changes in hydrology attributable to water drafting or to changes in peak flows from improperly drained roads could (a) affect frog reproduction by scouring eggs from the water body or (b) lead to direct mortality of frogs from water drafting equipment. Conducting surveys could potentially cause harm through handling or interference with feeding, migration, or breeding. Sampling of fish populations with methods such as electrofishing and out-migrant trapping could cause direct harm to frogs or interfere with their feeding, migration, or breeding.

12.3.4.2.2 Mitigation that offsets the effects of forest management

MRC has developed mitigation measures to specifically offset or minimize effects on red-legged frogs (C§10.2.2.3-1 to C§10.2.2.3-15). The conservation measures for red-legged frogs focus on protecting habitat and maintaining occupancy at breeding sites in the plan area. Conservation measures for red-legged frogs will (a) enhance aquatic habitat; (b) minimize disturbance to wet areas, wet meadows, and breeding habitats; (c) control non-native species (bullfrogs); and (d) ensure that breeding habitat is available throughout the plan area.

MRC will minimize disturbance in potential and documented red-legged frog breeding habitat by (a) using vegetation management techniques; (b) maintaining equipment limitation or exclusion zones; (c) limiting the amount of water drafting, particularly during the early summer; and (d) employing water drafting techniques designed to minimize impacts on aquatic organisms. We will also implement a bullfrog control plan to prevent bullfrogs from establishing populations in red-legged frog habitat.

To offset or minimize the effects of forest management, MRC has proposed conservation measures for red-legged frogs (C§10.2.2.3-1to C§10.2.2.3-15); for sediment inputs (section 8.3.3); and for hydrologic change (section 8.4). In addition, we will follow the standards in *Roads, Landings, and Skid Trails* (Appendix E) and comply with the *Master Agreement for Timber Operations* (Appendix T).

Wetland and riparian conservation measures that would offset or minimize potential impacts on red-legged frogs are primarily those developed to protect wetlands, wet meadows, wet areas, seeps, and springs. Conservation measures for wetlands, wet areas, and wet meadows include

- Maintaining equipment exclusion zones (EEZs) around wetlands.
- Avoidance of artificial wetlands.
- Retention of basal area.
- Felling hazard trees away from habitat and leaving the downed tree in place.
- Retention of old-growth and LWD.
- Avoidance of salvage.
- Surveying ponds prior to water drafting.

Conservation measures for seeps and springs include

- Protection of springs or seeps within AMZ boundaries.
- Extension of AMZ boundaries to encompass seeps and springs.
- Maintenance of EEZs.
- Felling of hazard trees away from habitat and leaving the downed tree in place.
- Management with uneven-aged silviculture.
- Retention of old-growth and LWD.
- Avoidance of salvage.
- Surveying of ponds prior to water drafting.

Implementation of the conservation measures for sediment input could minimize potential impacts from forest management that can increase the incidence of mass wasting and delivery of sediment to streams and ponds. MRC will analyze mass wasting and propose protection measures based on watershed analysis units. Conservation measures to address hydrologic change due to forest management incorporate conservation measures and policies designed or proposed for protection of other resources in the plan area. Measures include (a) uneven-aged management to produce forest canopy that minimizes stream flow changes; (b) increases in LWD recruitment; and (c) implementation of road design standards to minimize concentrated drainage. These measures will reduce erosion of channels and banks and benefit red-legged frogs by reducing sediment delivery to streams.

MRC has established standards for road management. Proper design of roads and landings prior to construction or reconstruction can eliminate many potential erosion problems and environmental impacts. An efficient road system will minimize hydrologic connectivity; point source and surface erosion; mass wasting; and maintenance and construction requirements and costs. MRC follows standards in all road and landing designs, which will minimize potential impacts to red-legged frogs.

The conservation measures for red-legged frogs will benefit the species by protecting preferred breeding and overwintering habitat, reducing the potential for direct mortality, minimizing the potential for increased sediment delivery to aquatic habitat, and minimizing potential impacts from water drafting.

12.3.4.2.3 Level of expected take

Table 12-17 shows impacts to known and potential red-legged frog habitat by decade over the term of the permit. More specifically, Table 12-17 shows the acreage and percent of the suitable habitat in the plan area that is impacted inside and outside of the AMZs, as well as the total impact on suitable habitat in the entire plan area. Table 12-18 breaks down this same data for individual inventory blocks.

Because MRC will enter a given stand multiple times over the term of the permit to conduct a variety of silvicultural activities, their operations may impact the same areas on the ground one or more times during the term of the permit. As a result, it would be inaccurate to simply add up individual acres to produce an overall impact acreage. For this reason, we calculated the percentage of impacted suitable habitat in each inventory block to show the relative level of impact expected in each decade.

Red-legged frogs use different habitat elements during different life phases. Breeding occurs in aquatic habitat. During the breeding season, most adult frogs would be found in or near breeding habitat; eggs and larval red-legged frogs are dependent on aquatic habitat. Only metamorphosed adult frogs are found in upland habitat outside the AMZ; the density of frogs decreases with distance from aquatic habitat because of a finite number of individuals within a larger area.

Over the 80-year term of the permit, a variety of silvicultural activities would occur in each inventory block in the plan area; impacts to individual sites would be about every 20-30 years, although this varies by site. Because silvicultural activities would occur both inside and outside AMZs, habitat degradation would also occur in both these areas. However, the amount of habitat disturbance that would occur inside AMZs is much less than outside AMZs. Conservation measures for red-legged frogs, in conjunction with maintenance of canopy cover and basal area within AMZs, would minimize impacts inside of AMZs.

Table 12-17 Suitable Habitat

		Red-legged Frog Suitable Habitat in the Plan Area							
		Potential Impacts By Decade							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Within AMZ	Total Acres	645	958	2633	4257	6194	7781	8862	9481
	% of Available	1%	1%	4%	6%	9%	12%	13%	14%
Outside AMZ	Total Acres	15,655	16,924	18,166	19,685	18,975	20,095	19,536	20,403
	% of Available	23%	25%	27%	30%	28%	30%	29%	31%
Combined	Total Acres	16,312	17,889	20,811	23,957	25,180	27,891	28,416	29,907
	% of Available	24%	27%	31%	36%	38%	42%	43%	45%
Total Acres of Suitable Red-legged Frog Habitat Available in the Plan Area = 66,626									

Table 12-18 RLF Habitat Impacts by Inventory Block

Red-legged Frog Suitable Habitat in the Plan Area									
Inventory Block	**Impact**	**Potential Impacts by Decade (Total Acres and % of Available Acres)**							
		1	2	3	4	5	6	7	8
Albion	In AMZ	72 1%	122 3%	195 4%	324 7%	505 11%	632 13%	667 14%	670 14%
	Outside AMZ	1042 22%	1050 22%	1239 26%	1339 28%	1264 26%	1352 28%	1326 28%	1376 29%
	Total	1114 23%	1172 24%	1434 30%	1663 35%	1769 37%	1984 41%	1993 42%	2046 43%
Big River	In AMZ	50 <1%	63 1%	400 4%	577 5%	634 6%	1034 9%	1499 14%	1561 14%
	Outside AMZ	2404 22%	2838 25%	3196 29%	3226 29%	3357 31%	3267 30%	3446 31%	3290 30%
	Total	2454 22%	2901 26%	3595 33%	3803 35%	3991 36%	4301 39%	4945 45%	4851 44%
Garcia River	In AMZ	67 1%	126 3%	214 5%	361 8%	406 9%	564 12%	525 11%	626 14%
	Outside AMZ	1167 25%	1420 31%	1193 26%	1476 32%	1238 27%	1573 34%	1309 28%	1587 34%
	Total	1233 27%	1549 34%	1407 31%	1840 40%	1644 36%	2141 47%	1840 40%	2225 48%
Navarro East	In AMZ	61 1%	143 2%	349 4%	421 5%	872 10%	1163 13%	1243 14%	1505 16%
	Outside AMZ	2371 26%	2520 27%	2625 29%	2962 32%	2782 30%	3097 34%	2822 31%	3135 34%
	Total	2431 27%	2663 29%	2974 32%	3383 37%	3654 40%	4260 46%	4065 44%	4641 51%
Navarro West	In AMZ	111 1%	160 2%	323 4%	324 8%	557 7%	796 10%	782 10%	973 13%
	Outside AMZ	1393 18%	1624 21%	1562 20%	2100 27%	1636 21%	2164 28%	1749 23%	2170 28%
	Total	1515 20%	1788 23%	1896 25%	2735 36%	2204 29%	2971 39%	2543 33%	3155 41%
Noyo	In AMZ	34 1%	83 2%	169 3%	315 6%	397 7%	641 12%	760 14%	837 15%
	Outside AMZ	1279 23%	2292 24%	1507 28%	1742 32%	1556 28%	1755 32%	1608 29%	1795 33%
	Total	1313 24%	1374 25%	1677 31%	2056 38%	1953 36%	2396 44%	2369 43%	2632 48%
Rockport	In AMZ	138 1%	112 1%	265 2%	556 5%	1351 12%	1482 13%	1763 15%	1765 15%
	Outside AMZ	3105 27%	3395 29%	3407 29%	3575 31%	3579 31%	3 630 31%	3646 31%	3744 32%
	Total	3243 28%	3507 30%	3672 32%	4131 36%	4929 43%	5112 44%	5409 47%	5509 48%
South Coast	In AMZ	113 1%	148 1%	715 7%	1067 10%	1469 13%	1447 13%	1617 15%	1509 14%
	Outside AMZ	2740 25%	2620 24%	3294 30%	3031 28%	3395 31%	3048 28%	3455 31%	3060 28%
	Total	2853 26%	2768 25%	4009 36%	4098 37%	4864 44%	4495 41%	5072 46%	4569 42%

Red-legged Frog Suitable Habitat in the Plan Area									
Inventory Block	**Impact**	**Potential Impacts by Decade (Total Acres and % of Available Acres)**							
		1	2	3	4	5	6	7	8
Ukiah	In AMZ	1 <1%	0 0%	2 <1%	13 1%	4 <1%	21 2%	5 <1%	35 3%
	Outside AMZ	154 11%	165 12%	145 11%	234 17%	167 12%	210 15%	175 13%	246 18%
	Total	155 11%	165 12%	147 11%	247 18%	171 13%	231 17%	181 13%	280 21%

Our conservation measures will minimize impacts to habitat with the highest concentration of red-legged frogs, particularly breeding habitat. Habitat alteration would occur within the AMZs but retention of canopy cover and basal area would minimize the impact of this alteration. Take of an unknown number of adult red-legged frogs could occur within the AMZs, particularly outside of EEZs or ELZs, in the form of direct mortality from use of equipment or falling trees. Disturbance to red-legged frogs in areas with ongoing silvicultural activities is also likely. However, direct mortality from habitat alteration is expected to be rare in the AMZs due to implementation of our conservation measures including retention of canopy cover and basal area. Take due to habitat alteration inside AMZs would vary by decade; the amount of impacted habitat would increase each decade (Table 12-17). In the AMZs, take would be associated with 645 ac of impacted habitat (i.e., 1% of all suitable habitat in the plan area) in Years 1-10 of HCP/NCCP implementation, and 9481 ac of impacted habitat (i.e., 14% of all suitable habitat in the plan area) in Years 70-80. Although the acreage of impacted habitat increases with each decade, the take from habitat disturbance should decrease as MRC continues to identify areas of occupied habitat through surveys conducted prior to silvicultural activities.

Direct mortality of an unknown number of adult red-legged frogs is also possible in suitable habitat outside of AMZs, where the majority of habitat impacts would occur. Mortality could result from equipment use or falling trees, as well as habitat alteration, particularly timber harvests, if changes in microclimate and cover lead to desiccation or increased predation. Areas outside of AMZs should have the lowest concentration of red-legged frogs because they are farther away from breeding habitat. Within the plan area, take from habitat alteration outside AMZs would vary by decade; the trend increases after the first decade. Outside of AMZs, take would be associated with 15,655 ac of impacted habitat (i.e., 23% of the total suitable habitat available in Years 0-10 of HCP/NCCP implementation) and with 20,403 ac (i.e., 31% of the total suitable habitat available in Years 70-80). Overall, take would be associated with 16,312 ac of habitat impact (i.e., 24% of total available habitat in Years 0-10 of HCP/NCCP implementation) and 29,907 ac (i.e., 45% of total habitat available in Years 70-80).

In addition to take related to timber management, which may include injury, death, harm, and harassment, some additional take in the form of harm or harassment of red-legged frogs will occur during research and monitoring. The basis for the MRC estimates are historic levels of field sampling and expectations of increases in sampling effort once the plan is in place. We estimate that, over the permit term, research and monitoring may result in harm or harassment to 2000 egg masses, 24,000 larval life stages, and 3200 post-metamorphic life stages (Table 12-19). MRC property is at the northern limits of a hybrid zone where California red-legged frogs and northern red-legged frogs are inter-breeding. We are cooperating with University of California (Davis) in a DNA sampling project to determine the extent of this hybridization. Biologists from both MRC and Davis are involved in the research and monitoring. We anticipate a greater need for DNA tissue sampling during the initial period of plan implementation given the current uncertainties about the boundaries and intergradation zone of the California and northern red-legged frog species. DNA sampling during the first 10 years of HCP/NCCP implementation could harm or harass as many as 5750 frogs. Take from research and monitoring may increase toward the later years of the permit term if the red-legged frog population increases and expands and MRC intensifies our monitoring efforts. The take estimates are maximum levels. In most cases, we can avoid handling red-legged frogs (i.e., avoid harm or harassment).

Table 12-19 Potential Take of Red-legged Frogs

Potential Take from Monitoring of Northern Red-legged Frogs									
Life Stage	Years Post HCP/NCCP Implementation								
	10[1]	20[1]	30[1]	40[1]	50[2]	60[2]	70[3]	80[3]	Total
Embryonic (numbers of egg masses)	1000*	100	100	100	150	150	200	200	2000
Larval	4000*	2000	2000	2000	3000	3000	4000	4000	24,000
Post-Metamorphic	750*	250	250	250	350	350	500	500	3200

TABLE NOTES

*Denotes time periods with likelihood of increased sampling for DNA data to inform MRC and UC (Davis) biologists about species range boundaries and hybrid zones. Annual estimate: 100 egg masses, 40 larva, 75 post-metamorphs.

[1]Annual estimate: 1 egg mass, 20 larva x 10 sites; 25 post-metamorphs
[2]Annual estimate: 1 egg mass, 20 larva x 15 sites; 35 post-metamorphs
[3]Annual estimate: 1 egg mass, 20 larva x 20 sites; 50 post-metamorphs

12.3.5 Coastal Tailed Frogs

12.3.5.1 Location and distribution in the plan area

Chapter 4 (section 4.6) provides a detailed species account of the coastal tailed frog, including geographic distribution, local distribution in the plan area, population trends, life history, and habitat requirements.

12.3.5.1.1 Suitable habitat in the plan area

Section 4.6.6 details the requirements, summarized here, for coastal tailed frog habitat. Coastal tailed frogs generally occur in streams in forested habitat with high canopy closure and, in lower abundance, in areas lacking canopy cover such as clearcuts (Hayes 1996, Metter 1964a, Bury and Corn 1988, Bury et al. 1991b). Adults also use moist, dense forested habitat adjacent to streams (Bury et al. 1991b). In the redwood zone of northwestern California, Diller and Wallace (1999) found that the following habitat variables were related to the presence of coastal tailed frogs:

- Landscape level – geologic formation.
- Reach level – percent fines, stream gradient, and water temperature.
- Microhabitat.

The Diller and Wallace study encountered tailed frog larvae more often in streams where cobble, boulder, and gravel substrates had low embeddedness, and less often in streams with fine substrates. Likewise, the study detected larvae more often in high gradient riffles and less often in pools and runs. The association of stream temperature appeared minimal in this study, however, that may be attributed to little variation being observed (Diller and Wallace 1999).

A study conducted in Douglas-fir and hardwood forests of northern California and southwestern Oregon found that the relative abundance of tailed frogs varied significantly between forest age classes, with greater abundance in older forests (Welsh and Lind 1991). Forest structure may be a more important factor than stand age in predicting the occurrence of tailed frogs; high canopy closure, low ambient temperatures, downed woody debris, and a deep duff layer are key attributes of that structure (Welsh 1990, Welsh et al. 1993).

Tailed frogs inhabit perennial streams, not ephemeral streams, because they commonly spend more than 1 year in the stream in their larval form (Brown 1990). Coarse substrates with low levels of fine sediment (low embeddedness) provide interstitial spaces for foraging and cover (Diller and Wallace 1999, Hawkins et al. 1988, Corn and Bury 1989). Tailed frogs are found in streams having a wide of range of gradients, with a range of 2% to 60% reported (Sutherland et al., as cited in Wahbe et al. 2001). They are less likely to occur in stream reaches with gradients greater than 50%, where bedload is probably mobilized more frequently (Dupuis et al. 2000).

Water temperatures in streams inhabited by tailed frogs are usually between 5^{o} and 16^{o} C (41^{o} and 61^{o} F) (Marshal et al. 1996). Cool water temperature is critical to tailed frog reproduction, and streams with water temperatures above 15^{o} C (59^{o} F) for extended periods are not suitable for reproduction (Hays 1996).

Adult tailed frogs use forest habitat adjacent to streams for foraging. Wahbe et al. (2004) found most tailed frogs stayed within 25 m of aquatic habitats; some frogs were 100 m out, which was the maximum distance from aquatic habitat that they sampled. Nussbaum et al. (1983) indicated that tailed frogs may forage up to 25 m (82 feet) from water, but are usually much closer.

MRC knows of 75 sites where coastal tailed frogs occur in the plan area, based on both surveys and incidental observations. From these sites, we collect data on stream temperature, canopy cover, stream gradient, and substrate embeddedness. [2]

Stream temperatures at known locations ranged from 11.0^{o} to 15.9^{o} C (51.8^{o} to 60.6^{o} F), with an average temperature of 13.1^{o} C (55.6^{o} F). Canopy closure was between 50 and 100%, with an average canopy cover of 84% for occupied sites. Stream gradient was recorded in ranges: 66 occupied sites (88%) had a stream gradient of 0 to 10%; 8 (11%) had a gradient of 10 to 25%; and 1 (1%) had a gradient of 40 to 50%. Table 12-20 shows substrate embeddedness also recorded in ranges.

Table 12-20 Stream Substrate Embeddedness

Stream Substrate Embeddedness Known Coastal Tailed Frog Sites		
Plan Area		
Embeddedness (%)*	**Number of Sites**	**% of Sites**
None reported	1	1%
0-25	18	24%
0-50	1	1%
25-50	47	63%
25-75	2	3%
50-75	6	8%
Total	75	100%

TABLE NOTE
*There is overlap in the ranges, due to differences in the way data was collected.

[2] Embeddedness is the degree to which fine sediment surrounds coarse substrate on the surface of the streambed.

Stream temperatures were within the expected range for occupied sites, and average canopy closure was high, as expected. Stream gradients of most sites were relatively low, but were within the range of 2 to 60%. Substrate embeddedness was below 50% for 88% of sites. Based on the known habitat associations of tailed frogs, potentially suitable habitat for this species has been defined, for the purposes of this analysis, as all Class I and Large Class II streams and the area within 300 ft of these streams. Table 12-21 shows the amount of coastal tailed frog habitat available in the plan area.

Table 12-21 Coastal Tailed Habitat

Suitable Coastal Tailed Frog Habitat in the Plan Area	
Inventory Block	**Acres**
Albion	2952
Big River	6780
Garcia River	2795
Navarro East	5601
Navarro West	4632
Noyo	3266
Rockport	7027
South Coast	6786
Ukiah	851
Total	**40,689**

12.3.5.2 Covered activities adjacent to suitable habitat

Covered activities that are expected to occur in or adjacent to occupied or suitable habitat during the permit term include timber management; road construction, reconstruction, maintenance, and use; stream habitat improvement; research and monitoring; and other HCP/NCCP activities.

Timber management includes timber harvest operations and silvicultural activities. Timber harvest includes harvesting, yarding, loading, and hauling timber. Silvicultural includes stand improvement and regeneration, specifically tree planting, seeding, site preparation, brush removal, broadcast burning, and fire control.

Road construction, reconstruction, maintenance, and use includes construction, reconstruction and maintenance of roads, landings, and skid trails; closure of both temporary and permanent roads and skid trails; construction and maintenance of stream crossings; drafting and use of water; development and use of rock pits; maintenance and fueling of equipment; and use of roads by outside parties under right-of-way agreements.

Stream habitat improvement projects include instream structure replacement, channel realignment, and bedload reduction. Research and monitoring include fish and fish habitat sampling, amphibian surveys, and distribution and abundance monitoring.

Timber management activities, particularly canopy removal, can decrease stream shade and cause changes to microclimates in the aquatic and riparian areas. Microclimate changes include changes in stream temperatures, stream temperature fluctuation, humidity, and wind velocity (Ledwith 1996; Chen et al. 1995, 1999). Increased stream temperatures can affect reproduction and development or survival of embryonic and larval forms (Zweifel 1955, Duellman and Trueb 1986, Balustein et al. 1994, both as cited in Asheton et al. 1999; Kupferberg 1996).

Removal of riparian vegetation can cause a decrease in humidity in riparian zones due to increased sunlight and wind. This can affect survival of frogs because they rely on high humidity levels and low wind velocity to prevent dehydration and allow respiratory functions. Modification of riparian canopy could result in a change in riparian plant species which in turn could alter the composition and production of algae. This could result in the alteration of food sources available to tadpoles and, potentially, adult coastal tailed frogs. Timber management activities in riparian habitat could also lead to direct mortality of individuals from crushing by equipment, falling trees, or humans walking through the area.

Timber management activities and road-related activities within a riparian area can result in a decrease in the amount of LWD in a stream by reducing the number of recruitment trees available (Bryant 1980, Andrus et al. 1988, Murphy and Koski 1989, Ralph et al. 1994). These activities could cause a change in the timing of LWD input, with large amounts potentially entering the system as a result of windfall of trees left in a buffer strip, followed by periods of little or no input as stands recover (Reid and Hilton 1998). Reduced LWD levels have been associated with reduced structural complexity and pool habitat (Keller and Swanson 1979, Sullivan et al. 1987, Montgomery et al. 1995, Beechie and Sibley 1997, Dominguez and Cederholm 2000). Coastal tailed frogs prefer channels and cascades; however, pools trap sediment and a reduction in pools could increase sediment delivery to preferred tailed frog habitat.

Timber management and road-related activities can also result in an increase in fine sediment in stream channels (Furniss et al. 1991). This can inhibit reproduction and foraging by coastal tailed frogs; inhibit attachment of eggs to substrate; fill interstitial spaces used by coastal tailed frogs; alter prey base by reducing algal and macroinvertebrate production; and reduce foraging success (Jennings and Hays 1994). Direct mortality may occur as a result of reduced foraging success, suffocation, and flushing of populations from habitat by debris torrents.

Timber management and road-related activities can reduce streambank stability, which can also result in increases in fine sediment in the stream and a loss of streambank features used by coastal tailed frogs for cover (FEMAT 1993, Sedell and Bescheta 1991, Swanson et al. 1982). Equipment and vehicles operating in riparian areas increase the risk of gas and oil pollution, which could harm or kill frogs.

Stream habitat improvement projects would generally benefit coastal tailed frogs in the long term; however, in the short term, site preparation can disturb soils and cause an increase in fine sediment in the stream. Broadcast burning could result in direct mortality of adults and alter riparian vegetation, causing changes in microclimate or sediment delivery.

Surveys for coastal tailed frog could potentially cause harm from handling or interfere with feeding, migration, or breeding. Likewise, sampling of fish populations with methods such as electrofishing and out-migrant trapping could directly harm frogs or interfere with feeding, migration, or breeding.

12.3.5.3 Mitigation that offsets the effects of forest management

To offset or minimize the effects of forest management, MRC has proposed conservation measures for coastal tailed frogs (C§10.2.3.3-1 to C§10.2.3.3-9); for wetland and riparian areas (C§8.2.3.5.1-1 to C§8.2.3.5.1-12); for sediment inputs (section 8.3.3); and for hydrologic change (section 8.4). In addition, we will follow the standards in *Roads, Landings, and Skid Trails* (Appendix E) and comply with the *Master Agreement for Timber Operations* (Appendix T).

MRC may designate basins as Large Class II due to the presence of coastal tailed frogs; as a result, these basins would receive increased protection. This would result in wider AMZs and increased protection of riparian habitat.

The conservation measure for wetland riparian areas that would most benefit coastal tailed frogs is the establishment of AMZs around Class I and Large Class II streams. AMZs will have 3 bands, and the band widths will vary by stream class and the slope class (percent) of the adjacent riparian area (C§8.2.3.1.1-1). Total AMZ widths for Class I streams would range from 130 ft to 190 ft. Total AMZ widths for Large Class II streams would range from 100 ft to 150 ft. Within AMZs, MRC will maintain large trees and overstory canopy and limit equipment disturbances. There will be a 10-ft no-harvest zone adjacent to Class I, Class II, and Class III streams for non-sprouting species, with limited harvest allowed within redwood clumps (see section 8.2.3.1); in the remaining AMZ areas, there will be selective harvest consistent with retaining canopy cover (C§8.2.3.1.2-1), basal area (C§8.2.3.1.3-1 to C§8.2.3.1.3-3), and largest tree retention (C§8.2.3.1.4-1 to C§8.2.3.1.4-5).

Forest management can potentially increase the incidence of mass wasting and delivery of sediment to streams; conservation measures for sediment inputs (section 8.3.3) would minimize these impacts. MRC will analyze mass wasting and propose protection measures based on watershed analysis units. Our strategy emphasizes high protection near watercourses where the risk for sediment delivery from mass wasting is critical. This is especially true for inner gorge terrain and steep streamside slopes. We will promote the upslope integrity of hydrologic processes and tree-root strength through default conservation measures for specific terrain. Furthermore, MRC will retain larger trees to provide LWD to stream channels if a hill-slope failure does occur. Within each CalWater planning watershed across our timberlands, MRC will also retain at least 50% average overstory canopy to mitigate the effects of timber harvest on hydrologic changes at the watershed scale.

Conservation measures to address hydrologic change due to forest management would not be unique but would incorporate conservation measures and policies designed or proposed for protection of other resources in the plan area. Uneven-aged management which provides forest canopy to minimize peak and low stream flow changes, increases in LWD recruitment, and implementation of road design standards to minimize concentrated drainage will reduce erosion of channels and banks. This would benefit coastal tailed frogs by reducing sediment delivery to streams.

MRC has established standards for road management (*Appendix E*) from which MRC will not deviate without first obtaining approval of the appropriate regulatory agencies for explicit alternatives. Proper design of roads and landings prior to construction or reconstruction can eliminate many potential erosion problems and environmental impacts. An efficient road system will minimize hydrologic connectivity; point source and surface erosion; the probability of mass wasting; and maintenance and construction requirements and costs. This, in turn, will minimize potential impacts to coastal tailed frogs.

AMZs would provide protection for coastal tailed frog habitat by maintaining high canopy cover to minimize potential stream temperature and microclimate changes; maintaining a 10-ft no harvest buffer to minimize the risk of fine sediment input into streams ; maintaining stream bank integrity; and limiting ground disturbance caused by equipment. Limiting the use of equipment within the AMZs would also reduce the potential for direct mortality of coastal tailed frogs by crushing.

12.3.5.4 Level of expected take

Table 12-22 shows the projected impacts to known and potential coastal tailed frog habitat, inside and outside AMZs, for each decade of our HCP/NCCP. Table 12-23 breaks down the same data by inventory block. Because MRC will enter a given stand multiple times over the term of the permit to conduct a variety of silvicultural activities, the same areas on the ground may be impacted one or more times during the term of the permit; therefore, impact acres cannot be added to produce an overall impact acreage. For this reason, the percentage of suitable habitat in each inventory block that would be impacted by decade was calculated to show the relative level of impact expected in each decade.

Table 12-22 CTF Suitable Habitat

		Coastal Tailed Frog Suitable Habitat in the Plan Area							
		Potential Impacts By Decade							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Within AMZ	Total Acres	417	673	2,252	3,833	5,758	7,318	8,394	9,010
	% of Available	1%	2%	6%	9%	14%	18%	21%	22%
Outside AMZ	Total Acres	6,745	7,322	7,850	8,484	8,168	8,649	8,399	8,776
	% of Available	17%	18%	19%	21%	20%	21%	21%	22%
Combined	Total Acres	7,168	8,000	10,108	12,326	13,931	15,977	16,803	17,799
	% of Available	18%	20%	25%	30%	34%	39%	41%	44%
Total Acres of Suitable Coastal Tailed Frog Habitat Available in the Plan Area = 40,689									

Table 12-23 CTF Suitable Habitat by Inventory Block

Coastal Tailed Frogs Suitable Habitat in the Plan Area									
Inventory Block	**Impact**	**Potential Impacts by Decade (Total Acres and % of Available Acres)**							
		1	2	3	4	5	6	7	8
Albion	In AMZ	49 2%	97 3%	167 6%	289 10%	469 16%	594 20%	629 21%	631 21%
	Outside AMZ	451 15%	465 16%	541 18%	589 20%	552 19%	595 20%	578 20%	605 20%
	Total	500 17%	562 19%	707 24%	879 30%	1021 35%	1188 40%	1207 41%	1236 42%
Big River	In AMZ	34 <1%	38 1%	352 5%	523 8%	580 9%	978 14%	1439 21%	1505 21%
	Outside AMZ	1050 15%	1358 19%	1413 21%	1430 21%	1471 22%	1448 21%	1509 22%	1458 21%
	Total	1084 16%	1296 19%	1766 26%	1953 29%	2051 30%	2426 36%	2949 43%	2962 44%
Garcia River	In AMZ	50 2%	101 4%	190 7%	332 12%	377 13%	534 19%	496 18%	595 21%
	Outside AMZ	504 18%	607 22%	518 19%	639 23%	536 19%	675 24%	566 18%	679 21%
	Total	554 20%	711 25%	708 25%	974 35%	913 33%	1212 43%	1068 38%	1282 46%
Navarro East	In AMZ	35 1%	89 2%	293 5%	346 6%	803 14%	1075 19%	1171 21%	1414 25%
	Outside AMZ	1040 19%	1077 19%	1164 21%	1286 23%	1223 22%	1339 24%	1239 22%	1358 24%

Coastal Tailed Frogs Suitable Habitat in the Plan Area									
Inventory Block	**Impact**	**Potential Impacts by Decade (Total Acres and % of Available Acres)**							
		1	2	3	4	5	6	7	8
	Total	1075 19%	1167 21%	1457 26%	1632 29%	2026 36%	2415 43%	2410 43%	2771 49%
Navarro West	In AMZ	86 2%	130 3%	277 6%	568 12%	505 11%	734 16%	725 16%	910 20%
	Outside AMZ	574 12%	669 14%	642 14%	836 18%	667 14%	861 19%	709 15%	862 19%
	Total	666 14%	801 17%	925 20%	1411 30%	1178 25%	1602 35%	1440 31%	1779 38%
Noyo	In AMZ	21 1%	65 2%	141 4%	286 9%	367 11%	611 19%	721 22%	805 25%
	Outside AMZ	542 17%	551 17%	637 19%	721 22%	656 20%	726 22%	678 21%	743 23%
	Total	563 17%	616 19%	777 24%	1007 31%	1023 31%	1337 41%	1399 43%	1548 47%
Rockport	In AMZ	76 1%	62 1%	179 3%	486 7%	1255 18%	1407 20%	1665 24%	1689 24%
	Outside AMZ	1315 19%	1474 21%	1448 21%	1555 22%	1519 22%	1577 22%	1546 22%	1627 23%
	Total	1391 2%0	1535 22%	1627 23%	2041 29%	2775 39%	2984 42%	3211 46%	3316 47%
South Coast	In AMZ	66 1%	91 1%	651 10%	994 15%	1399 21%	1371 20%	1545 23%	1433 21%
	Outside AMZ	1202 18%	1145 17%	1431 21%	1327 20%	1474 22%	1334 20%	1500 22%	1339 20%
	Total	1268 19%	1235 18%	2083 31%	2321 34%	2873 42%	2705 40%	3045 45%	2773 41%
Ukiah	In AMZ	1 <1%	0 0%	1 <1%	9 1%	2 <1%	14 2%	3 <1%	28 3%
	Outside AMZ	67 8%	76 9%	56 7%	100 12%	70 8%	94 11%	73 9%	105 12%
	Total	68 8%	76 9%	57 7%	109 13%	72 8%	108 13%	76 9%	133 16%

Coastal tailed frogs use different habitat elements during different life phases. Breeding occurs in aquatic habitat. During the breeding season, most adult frogs would be found in or near breeding habitat; eggs and larval coastal tailed frogs are also dependent on aquatic habitat. Only metamorphosed adult frogs are found in upland habitat; one would expect the density of frogs to decrease with distance from aquatic habitat.

Over the 80-year term of our permit, a variety of silvicultural activities will occur in each inventory block in the plan area; individual sites will generally be impacted every third decade, although this will vary by site. Because silvicultural activities will occur both inside and outside of the AMZs, habitat degradation will occur in both areas. However, there will be fewer disturbances inside the AMZs than outside, as shown in Table 12-23. Conservation measures for coastal tailed frog (C§10.2.3.3-1 to C§10.2.3.3-9), in conjunction with maintenance of canopy cover and basal area within AMZs, will minimize impacts inside AMZs.

Take of an unknown number of adult coastal tailed frogs could occur within the AMZs in the form of direct mortality from use of equipment or falling trees. Disturbance to coastal tailed frogs in areas with ongoing silvicultural activities is also likely; however, direct mortality from habitat alteration is not expected in the AMZs. Take from habitat alteration inside AMZs would vary by decade, with the amount of habitat impacted increasing each decade (Table 12-23). In the AMZs, take would be associated with 417 ac of habitat impacts, representing 1% of all suitable habitat in the plan area, during the first decade and would be associated with 9010 ac of habitat impact, 22% of suitable habitat in the plan area, in the eighth decade (Table 12-22). In the seventh and eighth decades, habitat impacts inside and outside of AMZs would be similar. Although the acreage of impacted habitat increases with each decade, the take from habitat disturbance is expected to decrease as MRC continues to identify areas of occupied habitat through surveys conducted prior to silvicultural activities.

Direct mortality of an unknown number of adult coastal tailed frogs is also possible in suitable habitat outside of the AMZs. In this area, where the majority of habitat impacts would occur, mortality could result from use of equipment or falling trees and also from habitat alteration, particularly timber harvests, if changes in microclimate and cover lead to desiccation or increased predation. Silvicultural activities such as thinning would be expected to have less impact than clearcut harvesting; therefore, the amount of take that would occur in a given site would vary depending on the type of activity conducted. Take from habitat alteration outside the AMZ would vary by decade, with an increasing trend from the first to the eighth decade. Outside of AMZs, take would be associated with 6745 ac of habitat impact, 17% of the total suitable habitat available, in the first decade and with 8776 ac, or 22% of the total suitable habitat available, in the eighth decade (Table 12-22). In the seventh and eighth decades, habitat impacts inside and outside of AMZs would be similar. Overall, in the first decade, take would be associated with 7168 ac of habitat impact, representing 18% of total available habitat in the plan area; 17,799 ac of habitat impact, i.e., 44% of total habitat available in the plan area, could occur in the eighth decade.

In addition to take related to timber management, which will include injury, death, harm, and harassment, some additional take in the form of harm or harassment will occur during research and monitoring. The basis for the MRC estimate of take was the historic capture rate at 10 sites. MRC assumed that harm and harassment from research and monitoring would increase over time as the number of coastal tailed frogs increases due to the beneficial effects of the plan. Over the permit term, we estimate that research and monitoring may harm or harass 67,000 larval life stages and 3000 post-metamorphic life stages of coastal tailed frogs (Table 12-24). The take numbers are maximum levels and MRC does not expect to approach the maximum levels with regularity.

Table 12-24 Potential Take of Coastal Tailed Frogs

Potential Take from Monitoring of Coastal Tailed Frogs										
Life Stages	Pre-NCCP/HCP	Years Post HCP/NCCP Implementation								
		10[1]	20[1]	30[1]	40[1]	50[2]	60[2]	70[3]	80[3]	Total
Larval	5000*	6000	6000	6000	10,000	10,000	10,000	12,000	12,000	72,000
Post-Metamorphic	300*	300	300	300	400	400	400	600	600	3300

TABLE NOTE
*Reflects the maximum number of animals captured at a relative abundance site (pre-HCP) and multiplied by 10 years
[1]Annual estimate: 60 larva, 3 post-metamorphs x 10 sites
[2]Annual estimate: 100 larva, 4 post-metamorphs x 10 sites
[3]Annual estimate: 120 larva, 6 post-metamorphs x 10 sites

12.3.6 Northern spotted owl

12.3.6.1 Location and distribution in the plan area

Chapter 5 (section 5.2) provides a detailed species account of the northern spotted owl, including geographic distribution, local distribution in the plan area, population trends, life history, and habitat requirements.

12.3.6.2 Suitable habitat in the plan area

Habitat suitability is based on tree type, dominant size class, and minimum canopy (Table 10-8). According to our 2007 baseline assessment for northern spotted owls, the plan area has 209,148 ac of forested land that could potentially grow into nesting/roosting habitat; 139,973 ac of foraging habitat; and 25,037 ac of non-suitable habitat (Figure 12-1).

Annual surveys conducted over a period of several years located 167 spotted owl territories in or adjacent to the plan area (Table 10-5). Under the HCP/NCCP, all spotted owl territories will receive some level of protection. The basis for protection is territory productivity, categorized as Level 1 through Level 5. Of the 167 territories, 28 are Level 1, 67 Level 2, 29 Level 3, 22 Level 4, and 21 Level 5 (Table 10-5). At HCP/NCCP commencement, Level-1 territories will receive high protection (C§10.3.1.3.1-1 to C§10.3.1.3.1-19); Level-2, moderate protection (C§10.3.1.3.1-20 to C§10.3.1.3.1-37); Level-3, limited protection (C§10.3.1.3.1-38 to C§10.3.1.3.1-41). Of the Level-4 territories, 17 will receive moderate protection and 5 limited protection. All Level-5 territories will receive moderate protection.

12.3.6.3 Covered activities adjacent to suitable habitat

Timber operations can alter the distribution of suitable habitat and cause forest fragmentation. They can affect spotted owl abundance and distribution by altering habitat structure and tree species composition. Forest fragmentation can isolate populations, provide clearings where spotted owls are subject to increased predation, and create habitat for competing species such as the barred owl (Gutièrrez 1985, Dark et al. 1998). Timber operations may result in the removal of 34 of the 167 territories in or adjacent to the plan area, as well as “excess” Level-1 and Level-2 territories; by excess we mean the number of territories that exceed our population objectives (O§10.3.1.2-1 and O§10.3.1.2-2). Timber operations may also result in the removal of spotted owls in areas where there were false negative surveys (i.e., an owl was present even though the surveys indicated the owl was absent). Inaccurate designation of habitat could increase involuntary direct and indirect take of northern spotted owls.

Forest management can lead to the modification or removal of nesting and roosting habitat, including removal of trees around nests, reduced canopy cover, or altered tree species composition. This may result in a reduction of nest and roost trees; changes in over- and understory vegetation composition and abundance; and changes in microclimate, including diurnal temperature fluctuation. Spotted owls prefer nest sites that are shaded and cool, such as sites in riparian areas. Changes in microclimate, including increases in temperature due to canopy removal, can increase physiological stress of the spotted owl and reduce its survival and reproductive success (Wasser et al. 1997).

Under the 50-11-40 rule of the Draft Recovery Plan of the Northern Spotted Owl (USFWS 2007), 50% of a land base should be in dispersal habitat provided by trees of 11 in. or greater with 40% canopy cover to sustain spotted owls. The description of dispersal habitat is approximately equivalent to foraging habitat within our HCP/NCCP. Forest practices can lead to the modification or removal of foraging and dispersal habitat. Timber harvest and subsequent seral-stage conversion could reduce or displace prey populations or alter prey species composition; other harvest activities, such as group selection, could increase prey species populations. . Alterations to foraging habitat can reduce prey availability or accessibility and, subsequently, foraging success (Sakai and Noon 1993, Ward et al. 1998). Reductions in dispersal habitat can decrease the chances that dispersing fledglings will reach vacant territories. Changes in prey availability may affect breeding success, establishment of activity centers, or fledging of young by owls of all productivity levels.

Noise disturbance can occur from timber management, construction of roads and landings, and rock pit activities. Noise-related impacts can be especially detrimental during the breeding season. This can potentially result in decreased reproductive success due to physiological stress, abandonment of the nest and young, or both.

Research and monitoring activities may lead to disturbance. Capturing and banding as well as other disturbances caused by researchers could adversely affect northern spotted owls by increasing stress and reducing nesting success. Surveys and monitoring for other covered species may cause disturbances to northern spotted owls. Mousing owls to determine reproductive status or to attempt banding may increase an owl's tameness and attraction to vehicle stimulus. Inaccurate designation of nesting, roosting, or foraging habitat may result in reduced protections and habitat benefits.

Relaxing the owl prior to banding

Banding the owl

12.3.6.4 Mitigation that offsets the effects of forest management

To minimize effects of fragmentation, MRC will

- Provide long-term maintenance and enhancement of spotted owl habitat through landscape planning and conservation measures for old growth, wildlife trees, downed wood, and riparian areas.
- Minimize adverse impacts to spotted owl habitat from timber operations.
- Rehabilitate tanoak-dominated stands to conifer or mixed-conifer stands.
- Maintain our "no clearcut" policy, as well as other habitat and species conservation measures that recruit high-quality habitat for spotted owls.
- Monitor all spotted owl territories for 3 years after they have been targeted for potential removal.

NOTE
Of the 34 territories initially subject to potential removal, many may remain despite harvesting.

- Survey areas scheduled for harvest following the protocol in Appendix K, *Northern Spotted Owl Data and Protocol*, in order to eliminate any false negative surveys.
- Identify activity centers prior to harvest and mark and retain all spotted owl nest trees.
- Protect spotted owl activity centers located along streams with additional conservation measures for riparian areas, salmonids, and amphibians.
- Manage for increased nesting/roosting habitat across the plan area so that the acreage of nesting/roosting habitat trends upwards to meet specified numeric objectives (Table 10-10).

To minimize effects on foraging and dispersal habitat, MRC will

- Maintain and recruit old growth, wildlife trees, downed wood, and dense canopy cover to minimize adverse impacts to the prey base of owls and allow for successful foraging and dispersal of spotted owl fledglings.
- Retain at least 500 ac of suitable habitat within 0.7 miles of activity centers with high and moderate protection.
- Manage our forests so that the amount of dispersal habitat on our land (i.e., foraging and nesting/roosting habitat) does not drop below 60% during the term of our HCP/NCCP, as our landscape model currently predicts.
- Retain mixed conifer stands that are preferred habitat of owl prey through conservation measures for riparian areas and hardwoods.

To minimize effects of noise, MRC will establish disturbance buffers during the breeding season to reduce noise impacts for all nesting owls. No-harvest buffers and restrictions on some harvest are expected to minimize noise around owl activity centers with high, moderate, and limited protection during the breeding season.

In addition, our proposed survey and monitoring will ensure that occupied and suitable habitat are identified. Spotted owls will benefit from our increased understanding of its habitat requirements, use patterns, reproductive biology, response to disturbance, and ecological interactions. By reducing uncertainties and increasing knowledge of spotted owl threats and requirements, MRC will improve management effectiveness. To minimize effects of monitoring, MRC will

- Use researchers approved by the wildlife agencies to capture and band owls.
- Monitor owls with high or moderate protection in the current year, as well as some owls with limited protection.
- Monitor only to determine the location of an activity center and the reproductive status of a northern spotted owl, so direct harm to an owl is unlikely, unless we band owls within a territory.
- Limit non-emergency vehicles from stopping within 1000 ft of any currently active nest site.

12.3.6.5 Level of expected take

For northern spotted owls, we define take in 3 ways:

1. Removal of habitat within 1000 ft of a spotted owl activity center (harm).
2. Reduction of nesting, roosting, or foraging habitat within 0.7 miles of the most current activity center to less than 500 ac (harm).
3. Disturbance within 1000 ft of a territory during the breeding season (harassment).

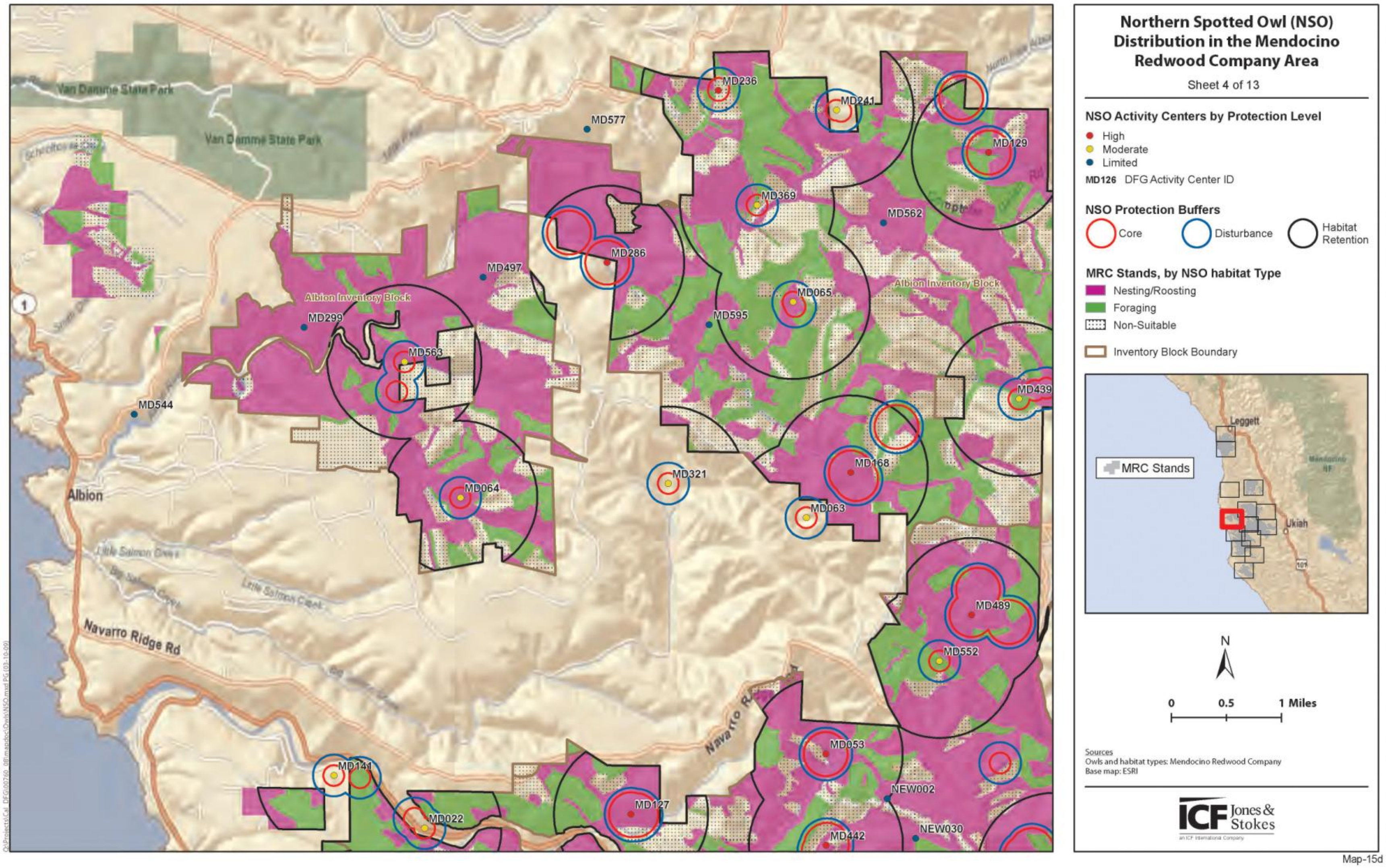


Figure 12-1 NSO Activity Centers by Protection Level

Direct injury or mortality should be very rare. It would occur when direct impacts result from false-negative surveys, i.e., surveys which fail to detect owls present. A total of 34 territories with limited protection (both inside and immediately outside the MRC property line) will be subject to take as defined above in #1 and #2. This will include 29 Level-3 territories and 5 Level-4B territories. Despite habitat removal, the level of actual mortality of spotted owls in these territories should be low, because (a) the territories already exhibit little if any productivity and (b) reduction of the habitat buffer is unlikely to result in spotted owl mortality. For 133 spotted owl territories in the plan area with moderate and high-level protection, covered activities will not result in take as defined above in #1 and #2 (see section 10.3.1.3).

Figure 12-1 shows one of several maps in our HCP/NCCP *Atlas* (MAPS 15A-N) that depict the spotted owl activity centers by protection level. Over the term of our plan, there may be a total of 1324 disturbances from covered activities resulting in degradation of 6754 ac within 34 territories with limited protection (Table 12-25). MRC based these calculations on the number of acres within 1000 ft of territories with some level of projected impact due to covered activities. Degradation of the 6754 ac could result in take through loss of habitat and indirect mortality, accompanied by changes in susceptibility to predation or availability of prey. Again, the level of actual mortality of spotted owls in these territories should be low, because (a) the territories already exhibit no or low productivity and (b) noise disturbance is unlikely to result in mortality of spotted owls.

Table 12-25 Potential Impacts to NSO Territories

Potential Disturbance Events and Impacts to Acreage in NSO Territories During the Term of HCP/NCCP

Inventory Block	Number of Silviculture Events	Acres[1]
Albion Inventory Block	184	946
Big River Inventory Block	88	422
Garcia River Inventory Block	121	676
Navarro East Inventory Block	215	1194
Navarro West Inventory Block	115	641
Noyo Inventory Block	135	682
Rockport Inventory Block	350	1616
South Coast Inventory Block	116	578
Total	**1324**	**6754**

TABLE NOTE
[1]Based on the number of acres impacted per territory per event within a 1000-ft buffer. Numbers are rounded.

During the breeding season, all spotted owl territories will have disturbance buffers of at least 500 ft. Territories with moderate and high protection will have 1000-ft disturbance buffers. MRC conservation measures permit use of mainline roads and other existing roads which are no closer to an activity center than a public road. There will be no creation of new roads and no tailhold and cable work in spotted owl territories and their associated buffers. As a result, MRC conservation measures will minimize the potential for disturbance or harassment, during the breeding season, to northern spotted owls in the 133 territories with high and moderate protection. Noise and other disturbance from covered activities during the breeding season may affect the 34 spotted owl territories with limited protection because these activities could occur within 500 ft of breeding sites.

The MRC goal for spotted owls is to increase their population in the plan area by 20%, from 95 Level-1 and Level-2 territories to 114. In order to accomplish this, MRC will manage 25% of the plan area to provide suitable nesting habitat. This is an increase of 8150 ac (18%), from the current 44,137 ac to 52,287 ac (Table 10-10). The expected increase in nesting/roosting habitat and population size will offset the expected take of spotted owls by habitat degradation.

12.3.7 Marbled murrelet

12.3.7.1 Location and distribution in the plan area

Chapter 5 (section 5.3) provides a detailed species account of the marbled murrelet, including geographic distribution, local distribution in the plan area, population trends, life history, and habitat requirements.

12.3.7.2 Suitable habitat in the plan area

Potential suitable habitat for marbled murrelets is based on known occurrences and habitat characteristics. Potential suitable habitat includes the LACMA site with known occurrences (Figure 12-2), Type I and Type II old-growth stands, and individual trees based on diameter and presence of platform branches. The tree diameter at breast height (dbh) must equal or exceed 48 in. for redwood trees and 36 in. for Douglas firs. The tree must also have at least 1 large limb (9 in. or more in diameter). For the purposes of this analysis, any tree with the required dbh and with branches identified by a forester as large was considered a potential murrelet tree.

Only a portion of the plan area has been surveyed for potential murrelet habitat: of the 83,088 ac of THP lands surveyed over the last 10 years (40% of plan area), 404 potential habitat trees have been identified. To determine the number of potential murrelet trees within the un-surveyed portion of the plan, we extrapolated based on the frequency of tree occurrence and the proportion of each inventory block surveyed. Based on this extrapolation, another 600 murrelet trees may be present within the plan area.

12.3.7.3 Covered activities adjacent to suitable habitat

Covered activities that may affect murrelets include timber operations (harvesting, yarding, loading and hauling timber), silviculture, and stand improvement. Timber activities can alter the distribution of suitable habitat and cause forest fragmentation, transforming large continuous forest patches into 1 or more smaller patches surrounded by disturbed areas. Forest fragmentation is a primary threat to marbled murrelets (Miller et al. 1995). This species uses contiguous patches of old-growth coastal coniferous forest for nesting (Hamer and Nelson 1995, Miller et al. 1995). Reduced canopy closure, an aftermath of fragmentation, allows for increased predation of murrelets (Nelson and Hamer 1995, as cited in Cooperrider et al. 2000). In addition, forest fragmentation increases available habitat for avian predators, allowing for further increases in predation (Ehrlich et al. 1988, Shuford 1993, Miller et al. 1995). Timber operations during the dry summer season may result in increased fire risk to murrelet habitat. Fire could reduce nesting habitat, decrease canopy cover, and increase predation risk.

Timber harvests can reduce forest canopy. Marbled murrelets use dense multi-storied canopies of old growth within coastal areas as nesting habitat (Miller et al. 1995, Miller and Ralph 1996) and for predator avoidance (Hamer and Nelson 1995). Reductions in canopy cover can result in increased predation and decreased nesting success. Helicopter operations close to nest trees during non-breeding season may remove vegetation, such as old branches, moss, etc. Removal of tree structures could reduce murrelet nesting habitat (Miller et al. 1995).

Silvicultural management for new marbled murrelet habitat growth in LACMA, including basal area and canopy closure requirements, could result in noise disturbance and changes in composition of vegetation. Noise during the breeding season could result in decreased reproduction from physiological stress and abandonment of the nest and young (Marshall 1988, Miller et al. 1995). Decrease in canopy cover can lead to increased predation and decreased nesting success (Hamer and Nelson 1995). Regeneration could affect marbled murrelet habitat due to changes in vegetation, canopy cover, and noise levels. Regeneration activities, including tree planting and seeding, site preparation and brush removal, broadcast burning and fire control may impact murrelets.

Covered activities that may create noise levels disturbing to murrelets include

- Timber operations.
- Forest regeneration.
- Stand improvement.
- Road, landing, and skid trail construction, reconstruction, and maintenance.
- Stream crossing construction and maintenance.
- Water drafting development and use.
- Rock pit development and use.
- Equipment maintenance and fueling.

Noise can be potentially detrimental during the breeding season, resulting in decreased reproductive success due to physiological stress, abandonment of the nest and young, or both.

Research and monitoring activities could result in direct and indirect effects on marbled murrelets. Invasive research and its associated disturbance could have adverse impacts on marbled murrelet due to increased stress and reductions in nesting success (Marshall 1988, Miller et al. 1995). Disturbances from research and monitoring are expected to have only minor impacts on marbled murrelets since no direct handling or invasive methods will occur.

All marbled murrelet habitat may not be located because of the difficulty in surveying. Determining occupied marbled murrelet habitat and identifying occupied areas based on habitat suitability is difficult. MRC conducted 271 ground surveys for murrelets from 1994-2007 and established 2007 as our baseline for assessment of take. From all the surveys, 22 resulted in detections of murrelets—all in Lower Alder Creek with the exception of 1 area in Greenwood Creek.[3] Using these numbers, MRC assumes approximately 8% (i.e., 22/271) of un-surveyed stands may be occupied. However, this percentage is biased since most detections occurred in Lower Alder Creek. Moreover, detections generally did not result in a determination that murrelets were occupying the area.

Retention of potential murrelet trees and increased surveys are unlikely to result in any detriment to murrelet populations. However, any harvest or additional surveys near potential habitat trees could increase predator abundance. Inaccurate classification of habitat could cause involuntary direct or indirect take of breeding marbled murrelets and their young. Retention of potential marbled murrelet trees will provide additional habitat and potential colonization areas. In limited

[3] In 2008, there was one ground detection for murrelets in the Marsh Gulch area. Further surveys suggested that murrelets were unlikely to actually occupy the area.

protection areas where there is no survey requirement, murrelets may occupy potential trees and experience greater predation rates. Increasing the intensity and extent of surveys as well as decreasing the time surveys remain valid will reduce the possibilities for harvest in areas occupied by murrelets.

12.3.7.4 Mitigation that offsets the effects of forest management

Outside the Lower Alder Creek area, MRC has proposed protocols for murrelet surveys, as well as protections in lieu of surveys. If MRC decides not to survey an area with potential habitat trees, we must still follow protection measures. In addition, MRC will not harvest any tree that has a high likelihood of being a potential habitat tree for murrelets.

Our HCP/NCCP will contribute to the conservation efforts for marbled murrelet in California. The core of our plan protects the existing murrelet population in the Lower Alder Creek watershed. Barring unforeseen circumstances, our protections will maintain this population and give it the opportunity to increase even more as surrounding areas produce potential murrelet habitat and nest trees. At that point, MRC will offer the wildlife agencies the chance to purchase some of these forested stands. In discussions with the wildlife agencies, we have designated 6 Murrelet Habitat Recruitment Stands (see section 10.3.2.3). Additionally, MRC will retain all trees that have a high potential to become murrelet nest trees even if our surveys indicate that a tree or stand is currently not occupied by murrelets.

Through our conservation measures, MRC will

- Provide long-term maintenance and enhancement of murrelet habitat through landscape planning and conservation measures for old-growth, wildlife trees, downed wood, and riparian areas.
- Protect 1237 ac of existing habitat in Lower Alder Creek, the only drainage in the plan area where occupied behavior has been observed.
- Provide increased protection stands outside of the Lower Alder Creek drainage with special restrictions to promote growth of murrelet habitat at an accelerated pace.
- Rehabilitate tanoak-dominated stands to become conifer or mixed conifer stands; such stands are more likely to become high quality murrelet habitat.
- Enforce a “no-clearcut” policy to reduce forest fragmentation.
- Maintain and enhance multi-storied canopy characteristic of old-growth forests required by murrelets for nesting.
- Restrict helicopter operations in the vicinity of nesting trees to minimize removal of vegetation and change habitat structure.
- Report fires or potential fire dangers to CDF.
- Provide buffers around occupied areas and potential habitat to reduce the likelihood of a fire reaching these locations.
- Allow only limited road-use in the vicinity of murrelet habitat with high and moderate protection during breeding season.
- Provide disturbance buffers to reduce noise from harvest and logging operations; the buffer sizes for high and moderate protection will meet or exceed U.S. Fish and Wildlife Service take avoidance criteria.
- Monitor marbled murrelet with radar and ground surveys that do not include handling of marbled murrelets; trained biologists will conduct the ground surveys.

NOTE
Marbled murrelets will benefit from surveys which increase our understanding of local population cycles and trends and allow us to detect occupied areas currently unknown.

- Limit survey and operational crews in LACMA to reduce the likelihood of increased predation rates.

For the LACMA area, protection levels during the breeding season are 0.25 miles, 0.5 miles, and 1 mile, respectively, for general, helicopter, and blast activities. Protection levels during the non-breeding season are a 300-ft and 500-ft buffer, respectively, for general and helicopter activities. For marbled murrelet trees currently identified as outside of LACMA, MRC based protection levels on the zone of the stand. We grouped trees based on number of potential murrelet trees within 100 ft. Following the criteria in Table 10-16, we will survey and protect these individual murrelet trees or groups of trees. Since areas with limited protection are unlikely to harbor murrelets, take at these locations is unlikely to cause direct mortality of murrelets. Table 12-26 shows protections for areas outside LACMA.

Table 12-26 Protections for Areas outside LACMA

Breeding Season		
Activity	Prescription	
	High and Moderate Protection	Limited Protection
General Silvicultural	Follow USFWS guidance per Table 12-26.	Retain murrelet trees and screen trees.
Helicopter	0.25 mile buffer	
Blasting	1 mile buffer	
Non-breeding Season		
Activity	Prescription	
	High Protection	Moderate Protection
General Silvicultural	100-ft buffer	75-ft buffer
Helicopter	300-ft buffer	200-ft buffer

12.3.7.5 Level of expected take

For marbled murrelets, we define take in 2 ways:

1. Habitat degradation or removal within 300 ft of marbled murrelet trees (i.e., harm in the form of habitat loss).
2. Disturbance which exceeds criteria listed in Table 10-17 and 10-18 (i.e., harassment of individuals).

MRC does not expect take in the form of direct injury or mortality of marbled murrelets to occur due to our protection of occupied habitat in Lower Alder Creek, i.e., core areas, habitat areas, and buffer areas. Moreover, we will protect other areas occupied by marbled murrelets with a ¼ mile disturbance buffer and a 300-ft habitat buffer. Although highly unlikely, it is possible that direct mortality of marbled murrelets could occur in areas where surveys return a false-negative result or where murrelets colonize after surveys.

The primary form of murrelet take will be habitat degradation or removal within 300 ft or more of murrelet trees. Un-surveyed areas given high and moderate protection will have 100- and 75-ft "no harvest" buffers, respectively. This is less than the standard 300-ft buffer for occupied stands. Limited protection areas have no buffer. Habitat degradation could adversely affect marbled murrelets within areas of limited protection. This would occur outside LACMA in habitat areas consisting of individual murrelet trees. In areas of limited protection, MRC only protects individual murrelet trees.

MRC began surveying for individual wildlife tree in 1999 as part of THPs. In the field, we painted each identified wildlife tree with a "W" and recorded their individual characteristics on a data sheet as well as marking their location on a map. Next, we used this wildlife tree data to filter out all trees that did not meet the criteria as potential murrelet trees (section 10.3.2.3.4). We then determined which wildlife trees were individual trees and which were part of a clump of 2 or more trees within 100 ft of each other. We assigned limited protection to individual wildlife trees and either high or moderate protection to wildlife trees in a clump.

Table 12-27 shows potential take from disturbance of murrelets. Since our murrelet habitat with high and moderate protection are equivalent to 2009 take-avoidance standards, we only assessed take for operations adjacent to habitat assigned limited protection. We used 2 different buffer distances, namely, 500 ft, a typical disturbance buffer, and 1320 ft, the disturbance distance associated with felling large trees, yarder whistles, and rock blasting (Table 10-18). We believe that 25% of operations near these individual trees would require a 1320 ft buffer under take-avoidance guidelines. According to our assessment, a total of 306 known murrelet trees are further than 100 ft from another murrelet tree. Because this is a rough assessment, we have allowed for sampling error by increasing the estimate 10% to 337 trees. Since we surveyed roughly 40% of covered lands for wildlife trees, we project that the remaining covered lands could result in 506 additional murrelet trees. This would amount to 843 individual murrelet trees in the plan area.

Table 12-28 shows potential take from degradation or removal of murrelet habitat. Since the current take-avoidance guidelines require a 300-ft "no harvest" buffer, all levels of MRC protection (high, moderate, and limited) will result in potential take as result of habitat degradation or removal. Because there is no habitat buffer for limited protection, operations within 300 ft of individual murrelet trees is take. There are 75- and 100-ft "no-cut" buffers for murrelet trees with moderate and high protection, respectively. To address take for murrelet trees with moderate or high protection, MRC subtracted the acreage of a 300-ft buffer (6.5 ac) from the acreage for the 75-ft (0.41 ac) or 100-ft buffer (0.72 ac) and then multiplied by the number of occurrences of each protection type.

To minimize murrelet harassment, MRC established disturbance buffers for the anticipated sound levels of various activities (Table10-18). Take as a result of disturbance may impact 37,751 ac over the term of the plan (Table 12-27). Take as a result of habitat degradation may occur in 5480 ac with limited protection, 944 ac with moderate protection, and 136 ac with high protection (Table 12-28).

These estimates are the worst case scenario for potential take of marbled murrelets. The assumption for this assessment was that murrelets actually occupy all habitat trees given high, moderate, and limited protection. In actual fact, we have only detected marbled murrelets during about 1% of our surveys; these detections are often not indicative of occupied behavior. Multiplying 1% of 37,751 ac equals only 377 ac. This much smaller number better represents the acreage potentially occupied by murrelets and subject to impact from disturbance. Moreover, MRC biologists will survey a portion of the 377 ac (25-50%) to determine murrelet occupancy; this will further reduce the possibility that take might occur within those 377 ac.

To minimize murrelet harassment, MRC established disturbance buffers for the anticipated sound levels of various activities (Table10-18). Take as a result of disturbance may impact 37,751 ac over the term of the plan (Table 12-27). Take as a result of habitat degradation may occur in 5480 ac with limited protection, 944 ac with moderate protection, and 136 ac with high protection (Table 12-28).

Table 12-27 Potential Take of Marbled Murrelet from Disturbance

Buffer	# Known Trees	Known Acres of Disturbance Take	Predicted # Trees	Predicted Acres of Disturbance Take	Total Trees	Total Acres of Take
500-ft buffer	253	4554	379	6822	632	11,376
1320-ft buffer	84	10,500	127	15,875	211	26,375
Total	337	15,054	506	22,697	843	37,751

Table 12-28 Table Potential Habitat Take of Marbled Murrelet

Protection Level	Known # Individual Locations	No-cut Buffer (ft)	Habitat Take Acreage*	Predicted # Individual Locations	Habitat take Acreage*	Total Individual Locations	Total Acres of Take
Limited	337	0	2191	506	3289	843	5480
Moderate **	62	75	378	93	566	155	944
High**	9	100	55	14	81	23	136
Total	448	NA	2624	613	3936	1021	6560

TABLE NOTES

*Habitat acreage = (Acreage 300 ft buffer [6.5] – acreage no-cut buffer) x number of locations)

** Our assessment did not include Type I and II old growth because MRC protection for these stands exceeds take avoidance standards.

These estimates are the worst case scenario for potential take of marbled murrelets. The assumption for this assessment was that murrelets actually occupy all habitat trees given high, moderate, and limited protection. In actual fact, we have only detected marbled murrelets during about 1% of our surveys; these detections are often not indicative of occupied behavior. Multiplying 1% of 37,751 ac equals only 377 ac. This much smaller number better represents the acreage potentially occupied by murrelets and subject to impact from disturbance. Moreover, MRC biologists will survey a portion of the 377 ac (25-50%) to determine murrelet occupancy; this will further reduce the possibility that take might occur within those 377 ac.

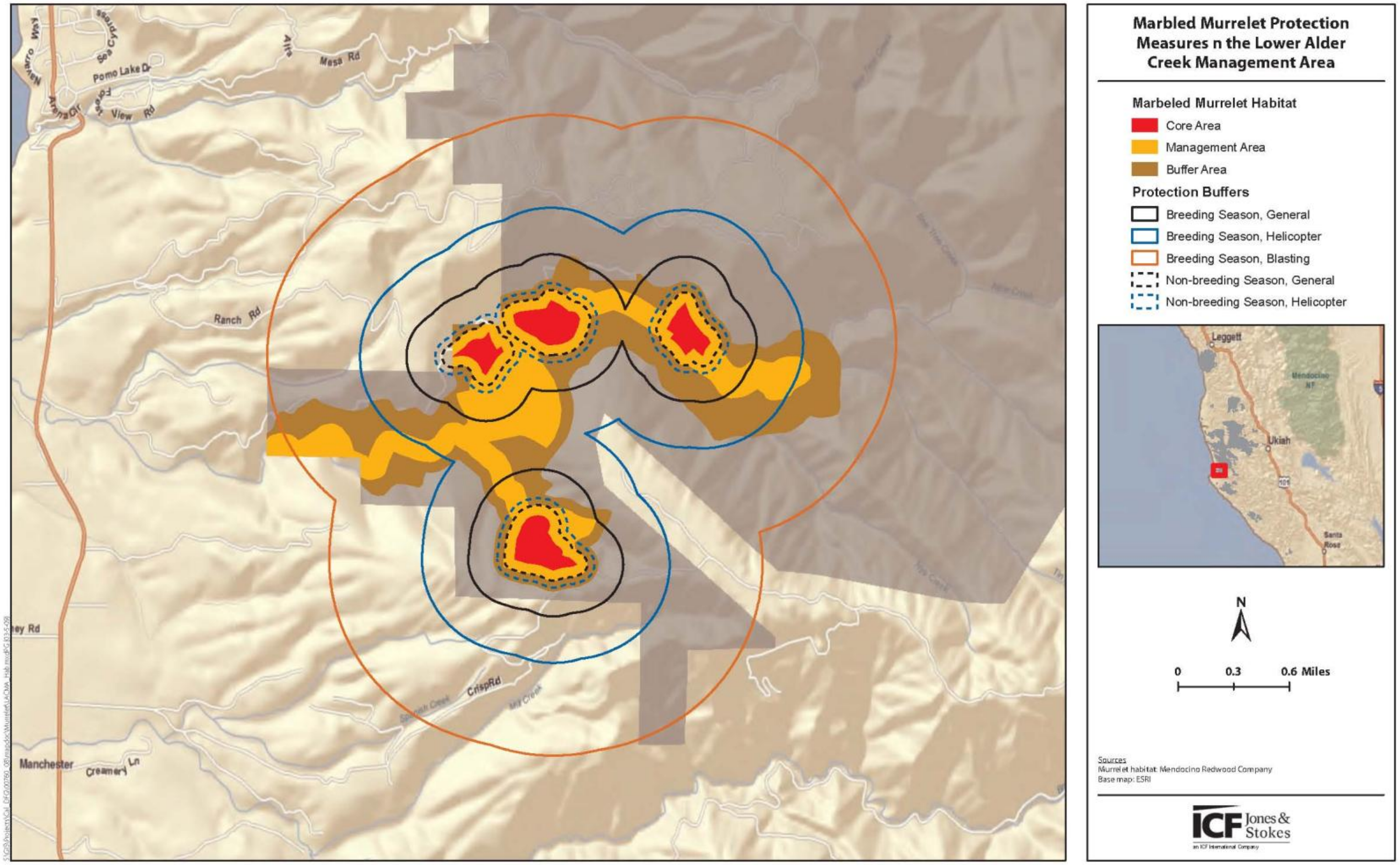


Figure 12-2 LACMA Habitat

12.3.8 Point Arena mountain beaver

12.3.8.1 Location and distribution in the plan area

Chapter 5 (section 5.4) provides a detailed species account of the Point Arena mountain beaver, including geographic distribution, local distribution in the plan area, population trends, life history, and habitat requirements.

12.3.8.1.1 Known burrow locations for assessment analysis

There are approximately 262 known sites of Point Arena mountain beavers; however, some reported sites may be part of the same burrow system.[4] Data on distribution of sites in the plan area is sparse but Point Arena mountain beavers have been observed in the watersheds of Mallo Pass Creek/ Mills Creek and Alder Creek (USFWS 1998a and MRC data, 2007) (Figure 12-3). Mountain beaver presence in these watersheds is known to occur at 14 burrow systems, although burrows 8 and 10 are likely one system.[5] One additional burrow system, adjacent to Point Arena Creek, is outside the plan area. The burrow systems are at small disjunctive sites generally separated by unsuitable habitat.

In the plan area, burrow systems of Point Arena mountain beaver are generally in riparian forests and at locations where there are freshwater seeps and brush. Burrow sites are rarely in conifer stands. Most of the known burrow systems in the plan area (i.e., 64% of burrow systems and 60% of their acreage) are within the inner or middle bands of the riparian buffers for Class I or Large Class II streams. This puts them within 130 ft of the streams. However, 1 burrow system (1) is above a small Class III Stream; 2 burrow systems (11 and 12) are outside the buffer of a Class I stream but in close association with several other burrow systems within the riparian buffer; and 2 burrows (3 and 4) are 250 and 400 ft, respectively, from a Class I stream.

The known burrow systems in the plan area, based on GIS data, total 1.87 ac. However, 3 of the burrow sites are currently point locations; MRC has not surveyed or mapped the areal extent of the burrow system. Information suggests that the sizes of the burrow systems are from 0.06 ac to 0.57 ac. Using the largest burrow system size, i.e. 0.57 ac, to estimate the acreage of the 3 point locations, MRC concludes that all known burrow systems in the plan area total approximately 3.58 ac.

Our HCP/NCCP assessment area for the Point Arena mountain beaver extends up and down the coast for approximately 20 miles and inland for 5 miles in the Garcia River and South Coast inventory blocks. MRC has surveyed 33 THPs for mountain beaver burrow systems since 2004. In the assessment area, there are approximately 2877 ac within 200 ft of Class I and Class II streams. MRC has surveyed about 691 of these acres to determine whether or not Point Arena mountain beavers occupy any areas scheduled for harvest under THPs. Therefore, 2186 ac of potential mountain beaver habitat remain un-surveyed. MRC discovered 1 of the 14 known burrow systems (14) during the pre-harvest THP surveys; the rest were discovered prior to THP surveys. Figures 12-3 through 12-6 show the known locations of burrow systems. Although 1 burrow system occurs along Point Arena Creek, which is outside the plan area, surveys of other areas in the Garcia inventory block have not resulted in any detection of Point Arena mountain beaver burrow systems.

[4] Email to Craig Hansen (ICF J&S) from John Hunter (USFWS) on 01/08/09
[5] Telephone conversation between Sarah Billig (MRC) and Craig Hansen (ICF J&S) on 02/28/08

MRC will conduct pre-harvest THP surveys and long-term monitoring to protect potential breeding sites of mountain beaver. By increasing information about the mountain beaver, these surveys will decrease the potential risk of *take*.

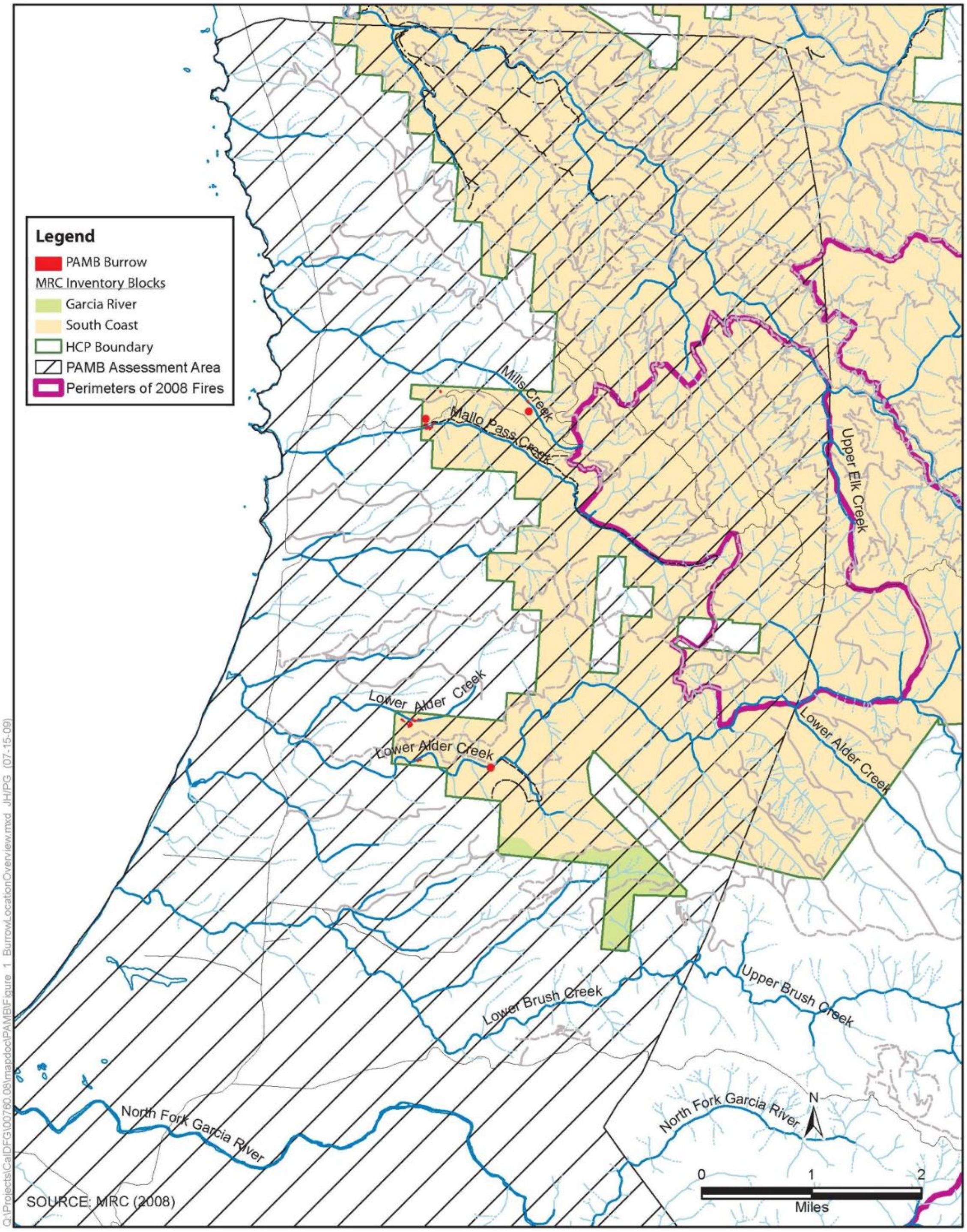


Figure 12-3 Burrow Locations of Point Arena Mountain Beaver (PAMB)

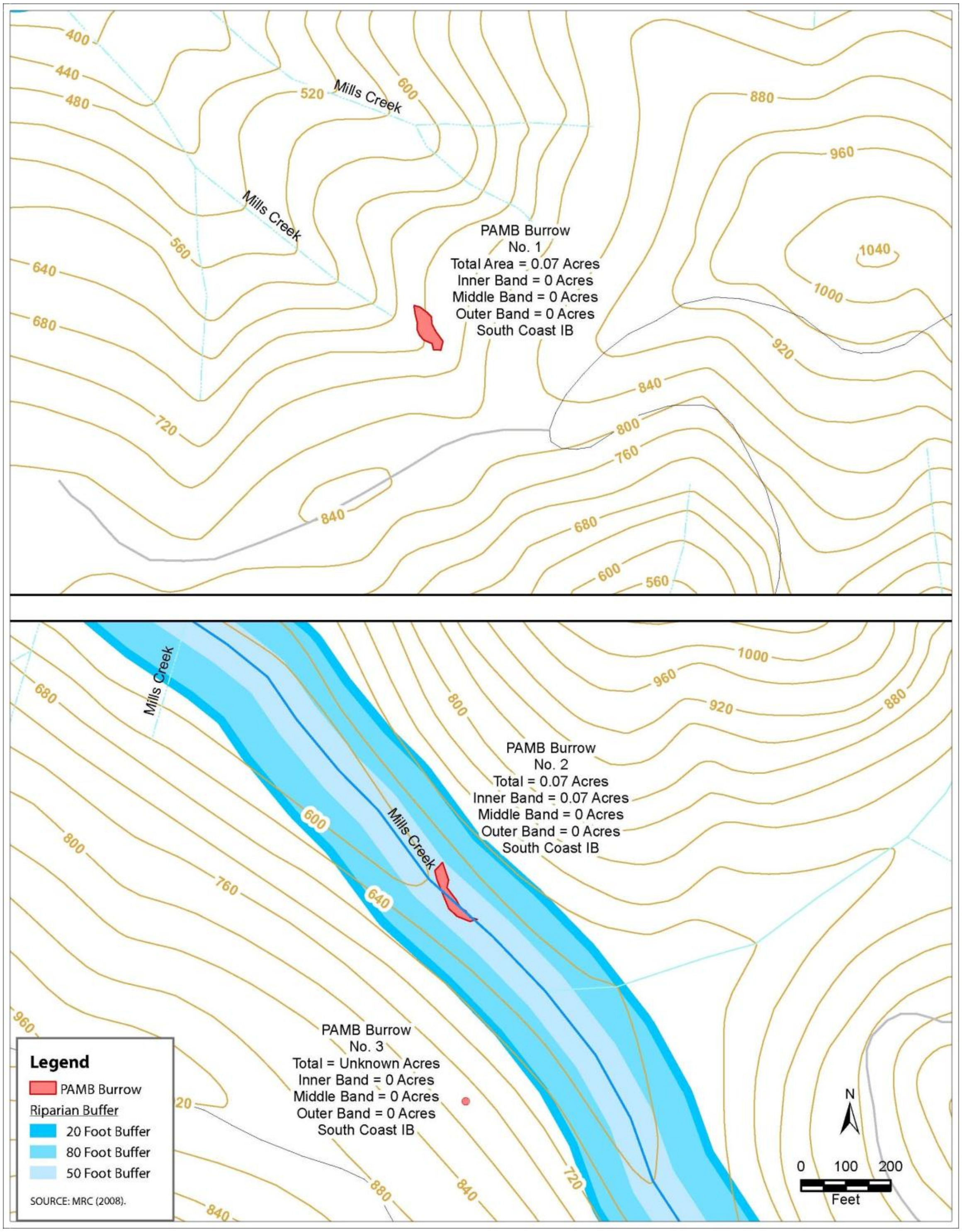


Figure 12-4 PAMB Burrow Locations 1, 2, and 3

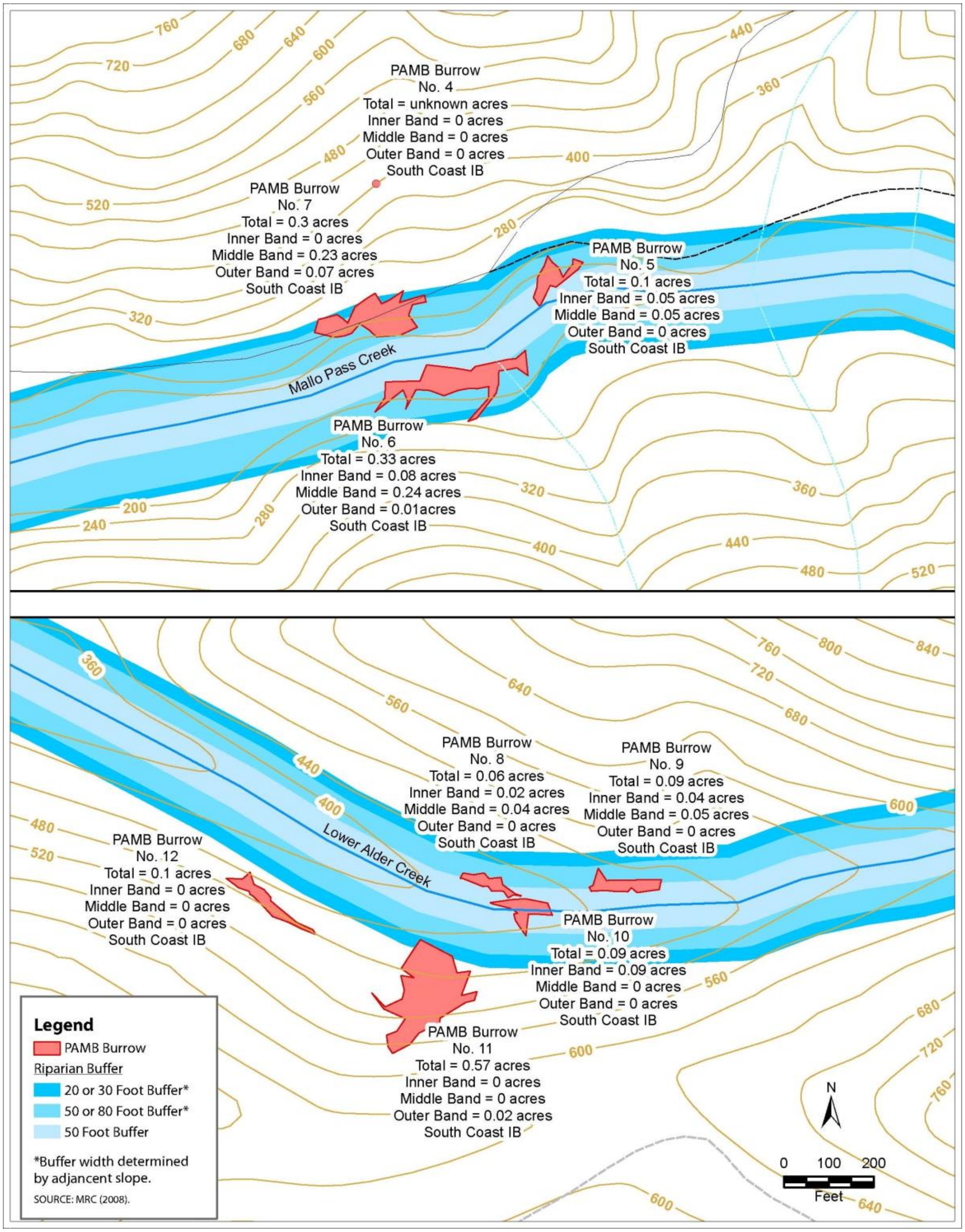


Figure 12-5 PAMB Burrow Locations 4 through 12

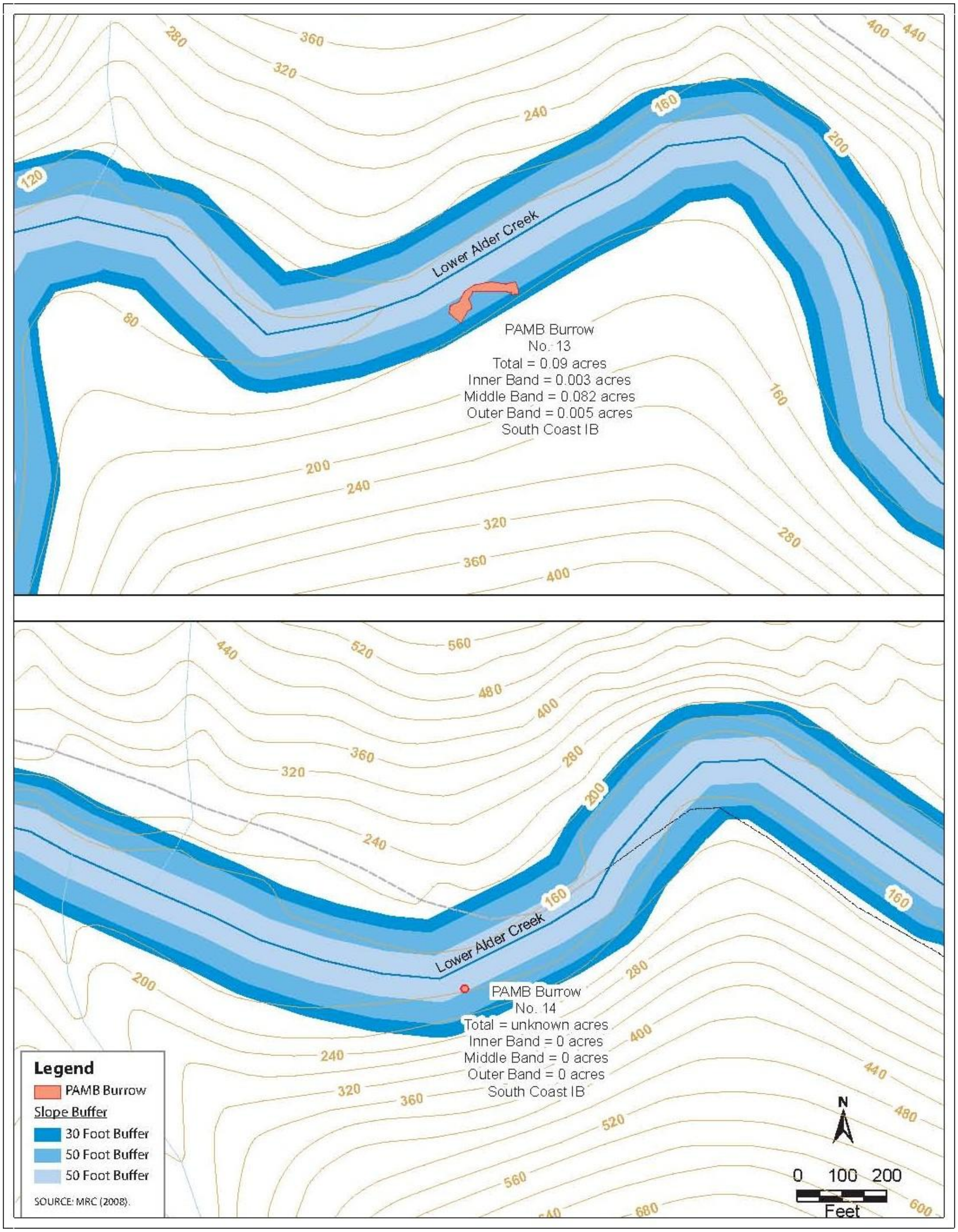


Figure 12-6 PAMB Burrow Locations 13 and 14

12.3.8.2 Suitable habitat in the plan area

Potential suitable habitat for the Point Arena mountain beaver is any area with herbaceous or brushy ground vegetation (excluding grasses) within 5 miles of the Pacific coast in the South Coast and Garcia inventory blocks. The likelihood of encountering mountain beavers in areas solely comprised of redwoods and Douglas fir, however, is very low. Since most known mountain beaver sites in the plan area are, based on GIS analysis, within approximately 130 ft of a stream, we estimate that potential habitat could occur within 200 ft of any stream in watersheds that currently have Point Arena mountain beaver. For sub-basins with known occupancy, i.e., Mallo Pass Creek/Mills Creek and Lower Alder Creek in the South Coast inventory block, and Garcia River in the Garcia inventory block, the amount of potential habitat may be 927 ac, 611 ac, and 1339 ac respectively. Based on the percentage of potential habitat surveyed—Mallo Pass Creek/Mills Creek (34%), Alder Creek (11%), and Garcia River (25%)—and on the known burrow systems along the creeks in each of the sub-basins, Table 12-29 shows the MRC estimates on potential occupied habitat. To arrive at the amount of potential occupied habitat by mountain beavers in Mallo Pass Creek/Mills Creek, for example, we made the following calculation:

EXAMPLE **Mallo Pass Creek/Mills Creek**	
suitable PAMB habitat	927 ac
% habitat surveyed	34%
surveyed habitat	315 ac
known burrow systems	.87

Potential occupied habitat = .87:315::x:927
315x=.87*927
315x= 806
x=2.5 ac (Table 12-29, row 1)

Table 12-29 Potential Occupied PAMB Habitat

Watersheds	Potential Habitat (ac)	% Potential Habitat Survey	Know Burrow Systems (ac)*	Potential Occupied PAMB Habitat (ac)
Mallo Pass Creek/Mills Creek	927	34	.87	2.5
Lower Alder Creek	611	11	1.00	9.1
Garcia River	1339	25	none**	4.0
			Total	15.6

TABLE NOTES
*Sum of "Total" burrow acres in each watershed (Figures 12-4 to 12-6)
**We used 1 ac in our calculations for Garcia River Watershed.

The Mendocino Lightning Complex of 2008 burned over 282 ac of potential Point Arena mountain beaver habitat in Mallo Pass Creek. It is unclear if the fire created new habitat or destroyed potential habitat. No known mountain beaver burrow systems were within the perimeter of the fire.

12.3.8.3 Covered activities and suitable habitat

Little is known about the sensitivity of mountain beavers to disturbance (USFWS 1998a). Because of their clumped and fragmented distribution, the subspecies is very vulnerable to catastrophic disturbances (natural or anthropogenic), such as storms, fire, flooding, landslides, disease, or prolonged drought (USFWS 1998a).

Cattle and sheep grazing have resulted in the loss and degradation of coastal scrub habitat used by mountain beavers (Steele 1989). Cattle may also adversely impact mountain beaver habitat by trampling burrows and crushing runways (i.e., travel pathways that rodents use in grassy or herbaceous areas), as observed at Alder Creek (Steele 1989). Livestock grazing could be an important factor limiting the expansion of existing sites of Point Arena mountain beaver (USFWS 1998a). However, MRC will not graze livestock in the plan area.

Urban development has been an important factor in the loss and degradation of coastal scrub habitat within the range of the Point Arena mountain beaver. Predation by feral and non-feral dogs and cats likely increases near areas of human habitation and may be affecting some sites (USFWS 1998a). Rodent and pest control by residents of urban development could result in negative effects on the Point Arena mountain beaver. The construction of private and county roads and the existence of State Highway 1 within the distribution of the Point Arena mountain beaver probably prevents or impedes dispersal between sites or into potentially suitable, unoccupied habitat (Steele 1989), as well as causing direct mortality (USFWS 1998a). Housing developments planned for the Irish Gulch area of Mendocino County may result in additional indirect and direct effects on Point Arena mountain beaver (USFWS 1998a). MRC is not proposing housing and infrastructure development in the plan area.

Gopher control programs have resulted in Point Arena mountain beaver mortality because mountain beavers were mistaken for gophers (USFWS 1998a). Trapping and poison baiting of rodents is common along the Mendocino County coast (Steele 1986). Use of other chemicals, such as pesticides and herbicides, may also result in mortality (USFWS 1998a). MRC has restrictions on chemical use, especially in areas where mountain beavers are known to occur.

Crushing of vegetation and burrows by campers and hikers may adversely affect sites of Point Arena mountain beavers (USFWS 1998a). Closure of sensitive areas to recreation has resulted in an increase in activity by mountain beavers (USFWS 1998a). In the plan area, there are no recreation sites near burrow systems of Point Arena mountain beaver.

Mountain beavers may respond relatively well to habitat changes precipitated by logging. Dense vegetation typically increases as overstory is removed (Sleeper 1997). Evidence indicates that mountain beavers may use openings in conifer stands and colonize areas where conifers have been removed (Scheffer 1929, Hooven 1973, Neal and Borrecco 1981). After logging occurs, mountain beavers seem to select sites where coarse woody debris remains (Hacker and Coblentz 1993). Falling trees and yarding may result, however, in direct injury or mortality to mountain beavers; logging may also damage their burrow systems.

The most likely MRC covered activities with the potential to adversely affect mountain beavers are timber harvest, road maintenance, and construction. These activities have the potential to directly affect mountain beavers by removing or degrading occupied burrows or suitable habitat, or causing disturbance or mortality to individuals in occupied burrow systems. Surveys might yield false negative results as well that could potentially result in impacts to mountain beavers and their habitat. Indirectly, timber harvest, road maintenance, and construction could eventually cause road failures that adversely affect mountain beavers and their burrow systems.

12.3.8.4 Mitigation that offsets the effects of forest management

The MRC conservation strategy for Point Arena mountain beaver is primarily a take-avoidance approach (C§10.3.3.3-1 to C§10.3.3.3-18). In brief, the combination of stream buffer protections, restrictions on road building near burrow systems, noise and disturbance buffers, and daily and seasonal restrictions on activities near occupied burrow systems will likely result in little, if any, *take* of mountain beaver from MRC forest management.

Survey efforts in areas likely to contain suitable habitat will ensure that MRC identifies both suitable and occupied habitat. If MRC discovers new burrow systems during surveys, we will protect them as occupied burrow systems. Moreover, MRC prohibits dogs in areas being surveyed. These measures should result in no *take* of Point Arena mountain beavers.
Under adaptive management provisions of our HCP/NCCP, MRC may experimentally harvest trees or manipulate downed log abundance and distribution within protective buffers to determine if such management within short distance of a burrow system will negatively impact the mountain beaver. Other mountain beaver species have responded positively to forest management activities[6]. Adaptive management has the potential to adversely or positively affect the mountain beaver or, perhaps, result in little or no effect.

12.3.8.5 Level of expected take

MRC does not expect our conservation measures to result in incidental *take* of Point Arena mountain beaver because they are a take-avoidance strategy. We will protect known occupied mountain beaver sites as well as newly discovered sites.

Road or landing failures could affect mountain beavers but the possibility is remote. MRC will implement management practices to prevent such failures and will restrict road-building near streams, an area where burrow systems routinely occur. These actions, coupled with the sparse distribution of mountain beaver burrow systems and their typical location within stream buffers, should result in a very low risk of *take*.

False negative surveys could impact mountain beavers. However, it is difficult to quantify the accuracy of surveys. MRC believes the risk of *take* from false negative surveys is low. Our biologists are trained in the proper protocol. They understand what constitutes suitable mountain beaver habitat. Their survey protocols are similar to those developed by USFWS. In following these protocols, surveyors have very little probability of concluding beavers are absent when, in fact, they are present.

Take may occur when MRC chooses to implement the adaptive management provisions relative to Point Arena mountain beaver. The *take* would be the acreage of the experimental burrow system and any individuals associated with the burrow system. MRC projects that we will implement the adaptive management provisions near 2 burrow systems per decade, with little or no adverse impacts to the burrow systems. If adaptive management does result in adverse impacts, we would desist.

The acreage of known burrow systems in the plan area ranges from 0.06 ac to 0.57 ac. Thus, the acreage of burrow systems that could be impacted by adaptive management, i.e. 2 burrow

[6] Email to Craig Hansen (ICF J&S) from Brad Valentine (CDFG) on 01/07/09

systems, ranges from 0.12 to 1.14 ac per decade. However, for purposes of determining the level of *take*, we assume that 2 of the largest burrow systems might be taken, which is 1.14 ac. If the adaptive management provisions prove to be unsuccessful, an undetermined number of Point Arena mountain beaver within the 1.14 acres of occupied habitat could be taken.

12.3.9 Covered rare plants

12.3.9.1 Level of expected take

Our take analysis was limited to the known occurrences of rare plants within the plan area. Due to insufficient data, we were unable to assess take for suitable habitat of covered species. In order to assess take for suitable habitat, a strong habitat model is needed to accurately predict locations where the species could occur. An essential component of a habitat model is a clear understanding of the habitat requirements for the species being modeled. Unfortunately, very little is known about the key microclimate conditions associated with the majority of the species covered by this plan. Therefore, no habitat models were developed for the covered species.

It is estimated that 10% of the plan area has been inventoried for covered plant species. MRC anticipates that new occurrences of species currently found in the plan area and new species not yet documented in the plan area will be discovered as pre-harvest surveys are conducted in areas not yet inventoried. Since our analysis lacked the capability to accurately predict the location of likely occurrences, it was not possible to account for take in these undiscovered occurrences. Therefore, we recognize that our analysis could under estimate the amount of take likely to occur from project activities carried out during the permit term, even with implementation of our conservation measures.

There are 31 plant species covered by our plan. Eleven of the species have been documented within the plan area and these are addressed in the take analysis (Table 12-30). The concept behind this analysis was to view the location and extent of plant occurrences and then overlay project activities to identify areas where they intersect. For plants in the forested environment, the conservation measures are designed to result in take avoidance. Plant locations elsewhere in the plan area may be affected by activities associated with roads, landings, and rock pits. These features were buffered: roads (buffered to match the existing road base); landings (buffered with .25 ac); and rock pits (buffered with .50 ac). The areas of intersection between the core occurrence areas and the buffered road, landing, and rock pit features represent potential take. One challenge we faced in running this process was that no data was available for the aerial extent of the plant occurrences. In order to give spatial extent to plant locations, we assigned a core occurrence area to each species. For species in management categories MC1 through MC3, we used the buffer sizes prescribed in their actual conservation measures, namely circles with a 150-ft radius for MC1 species and a 50-ft radius for MC2 and MC3 species (section 11.5). Generally, these buffers will be larger in the field than our conceptual geometry suggests. On the other hand, MC4 species and the 2 species for which MRC will apply species-specific conservation measures (Humboldt milk-vetch and long-beard lichen) do not have protective buffers. In the case of Humboldt milk-vetch, a MRC forester will mark the outer limits of the core occurrence area at least 5 ft beyond any of its visible parts (C§11.8.2-3). For long beard lichen, MRC will protect up to 10 source trees in any PTHP area (C§11.8.1-3). However, in order to quantify take for our analysis, we assumed that MC4 species, as well as Humboldt milk-vetch and long-beard lichen, had 50-ft buffers (Table 12-30). In this way, we could generate an estimate of take similar to our estimates for species in MC1-MC3.

Table 12-30 Take Analysis for Covered Plants

Potential Take of Covered Plants with Known Occurrences in the Plan Area								
Common Name	**Scientific Name**	**MC**	**Core Area Radius (ft)**	**Est. Take (ac)**	**Activities Associated with Take**			
					Timber Harvest	**Road**	**Landing**	**Rock Pit**
Humboldt milk-vetch	*Astragalus agnicidus*	na	50	51.1	X	X	X	X
Small ground-cone	Kopsiopsis hookeri	1	150	.1		X	X	
Swamp harebell	*Campanula californica*	3	50	1.68	X	X	X	
Oregon goldthreads	*Coptis laciniata*	2	50	.25	X	X	X	
Pygmy cypress	Hesperocyparis pygmaea	4	50	0.76		X	X	
Coast lily	*Lilium maritimum*	1	150	0.59		X		
Bolander's beach pine	*Pinus contorta* ssp. *bolanderi*	4	50	.1		X	X	
White-flowered rein orchid	*Piperia candida*	2	50	0.07		X		
North Coast semaphore grass	*Pleuropogon hooverianus*	1	150	2.77		X	X	
Maple-leaved checkerbloom	*Sidalcea malachroides*	4	50	1.4		X		
Long-beard lichen	*Usnea longissima*	Na	50	1.68	X	X	X	

TABLE NOTES
MC = management category
na = not assigned

A draw-back to assigning a core occurrence area in this way is that it does not reflect the actual size of the occurrence. This can be problematic in the take analysis by either over or under estimating take. As an example, consider a small occurrence (5 individuals) of species 'A', which is in MC2 and located along the roadside. This occurrence would be assigned a core occurrence area with a 50-ft radius, which likely over represents the actual area that the 5 individuals occupy (Figure 12-7).

For the take analysis, road related activities intersect the core occurrence area and a value of take is calculated. In our example, none of the individuals are actually affected by the road activities and take is over estimated. For occurrences with high numbers if individuals, the assigned core area will likely under represent the actual area the plants occupy and project activities could result in a larger amount of take than the analysis calculated (Figure 12-7).

With these potential problematic situations in mind, we analyzed take for the 11 covered species documented within the plan area. A summary of take for each species is presented below, specifically noting situations where take may be over or under estimated.

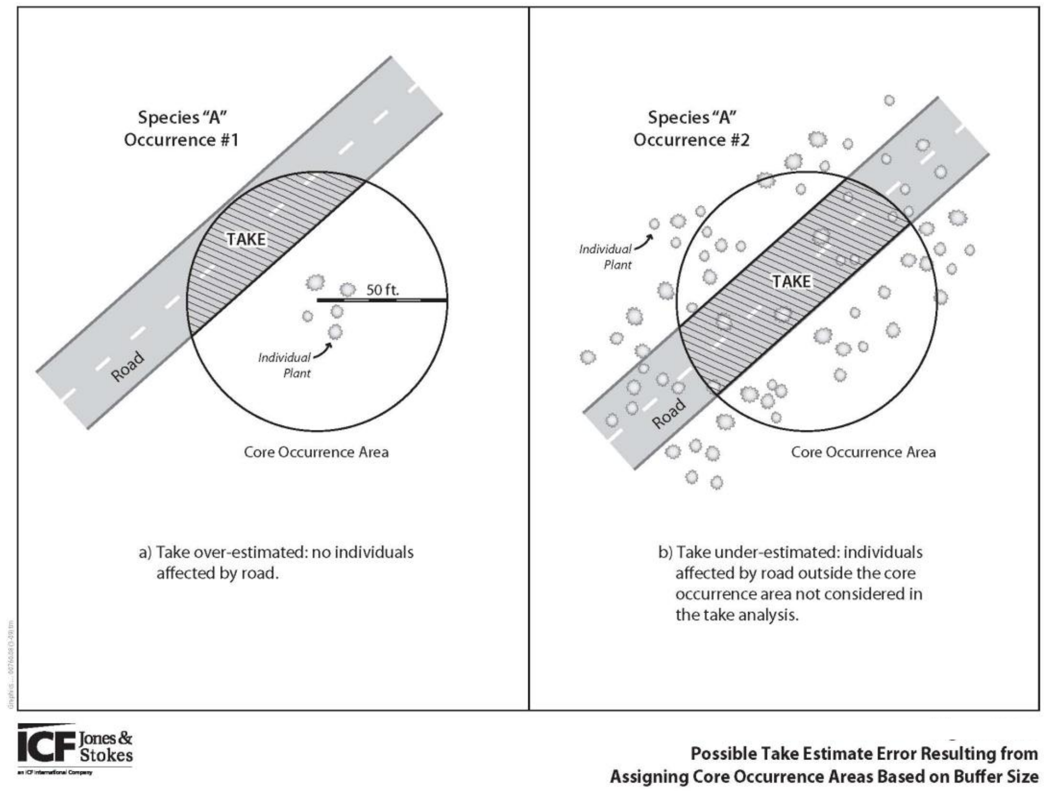


Figure 12-7 Possible Take Estimate Error

12.3.9.2 Humboldt Milk-vetch (*Astragalus agnicidu*s)

12.3.9.2.1 Location and distribution in the plan area

There are 23 documented occurrences of Humboldt milk-vetch in the plan area (see our HCP/NCCP *Atlas,* MAPS 16A-C). The majority of the occurrences are in the Rockport inventory block. However, there are reports of several occurrences from each of the following inventory blocks: Noyo, Big River, Navarro East, South Coast, and Garcia. Occurrences in South Coast and Garcia inventory block have not been mapped and do not appear in our HCP/NCCP *Atlas*. Thirteen of the occurrences reported 100 individuals or less, 5 of the occurrences reported numbers ranging from 100-1000 individuals, and 5 occurrences reported >1000 individuals. The largest occurrence comprised 8195 individuals in 2001, when it was first documented.

All occurrences were reported along roads, skid trails, and landings. Humboldt milk-vetch is typically found in North Coast coniferous forests and broadleaved upland forest at sites with soil disturbance and an open forest canopy.

12.3.9.2.2 Current condition of occupied habitat

The 2008 Mendocino Lightning Complex fires burned large portions of the Rockport inventory block, including almost all of the Humboldt milk-vetch occurrences located in that region. Approximately 88% of the Humboldt milk-vetch known in the plan area was located in the Rockport inventory block. In addition to disturbance from burning, the occurrences also experienced disturbance from vehicle traffic, staging activities, and construction of fire breaks. The effect of fire on these occurrences is not yet known. Future surveys will be needed to document conditions. It is possible that Humboldt milk-vetch will respond positively to the disturbance based on the following characteristics of the species: it thrives in open areas with disturbed soil, the seeds remain viable in the soil for long periods of time, and seed germination is stimulated by fire.

12.3.9.2.3 Forest management adjacent to occupied habitat

The forest matrix surrounding Humboldt milk-vetch occurrences is predominantly redwood/Douglas fir and conifer hardwood forest. The initial harvest prescription for most of the stands is rehabilitation, variable retention, or transition harvest. Harvest rotation is on a 20-year cycle with subsequent prescriptions calling for selection harvest. Additional harvest-related activities that will occur in the vicinity of Humboldt milk-vetch include the use and maintenance of roads, landings, and rock pits.

12.3.9.2.4 Mitigation that offsets the effects of forest management

Humboldt milk-vetch typically occurs in areas with active timber management. Since this species may actually benefit from timber harvest activities, MRC proposes species-specific conservation measures, rather than category-based conservation measures, to meet the biological objectives for the species as well as the intent of the take provisions. With this strategy, conservation objectives will be the same as for MC 2 while allowing timber operations to proceed without unreasonable constraints. Conservation measures include clearly marking the boundary of the core occurrence area and felling trees away from it when possible. However, limited activities will be permitted in the core occurrence area, including use of existing roads, landings, and rock pits.

12.3.9.2.5 Level of expected take

Conservation measures for Humboldt milk-vetch are sufficient to protect most individual plants from take. However, take of 51.1 ac of Humboldt milk-vetch may occur from use and maintenance of roads, landings, and rock pits, with very minor take from tree felling and yarding operations (Table 12-30). After reviewing the numbers of individuals in each occurrence, it is likely that 56% of the occurrences factored into the take calculation over estimate take and 22% of the occurrences under estimate take. The amount by which take was over or under estimated is unknown; therefore, the accuracy of the calculated acreage for take is uncertain.

12.3.9.3 Small Ground-Cone (*Kopsiopsis hookeri*)

12.3.9.3.1 Location and distribution in the plan area

One occurrence of small ground-cone is known within the plan area. It is located in the Albion inventory block and in 2002, when first documented, consisted of 5 plants growing along the roadside. This species typically occurs in open and shrubby areas within North Coast coniferous forest and close-cone coniferous forest.

12.3.9.3.2 Current condition of occupied habitat

A site description for the occurrences is currently not available.

12.3.9.3.3 Forest management adjacent to occupied habitat

The forest matrix surrounding small ground-cone occurrences is predominantly pygmy forest where MRC is not proposing harvests.

12.3.9.3.4 Mitigation that offsets the effects of forest management

Small ground-cone belongs to MC1 and receives a core occurrence area buffer with a 150-ft radius. All harvest-related activities are excluded from the core occurrence area. Limited activities are permitted within the buffer, including use of existing roads, landings, and rock pits.

12.3.9.3.5 Level of expected take

Conservation measures for small ground-cone are sufficient to protect individual plants from take. MRC does not expect take of the 1 known occurrence of ground-cone during the term of our HCP/NCCP; it is well away from a road and will be clearly marked during future operations. However, there may be minor take (.1 ac) from road and landing use in areas still un-surveyed for ground-cone (Table 12-30).

12.3.9.4 Swamp Harebell (*Campanula californica*)

12.3.9.4.1 Location and distribution in the plan area

The 6 occurrences of swamp harebell known in the plan area were located in the South Coast and Garcia inventory blocks. Two of the occurrences contain low numbers of individuals (< 6), while the remaining occurrences contain > 600 individuals. One occurrence in the Garcia inventory block had > 40,000 individuals in 2007. Many of the occurrences were reported from stream crossings (culverts), roadside ditches, and mesic locations on roads and landings. This species is typically associated with wetland habitats within coastal prairie, closed-cone coniferous forest, and North Coast coniferous forest.

12.3.9.4.2 Current condition of occupied habitat

A site description for the occurrences is currently not available.

12.3.9.4.3 Forest management adjacent to occupied habitat

The forest matrix surrounding swamp harebell occurrences is redwood/Douglas fir forest. The initial harvest prescription for most of the stands is transition harvest. Harvest rotation is on a 20-year cycle with subsequent prescription calling for selection harvest. Additional harvest-related activities that will occur in the vicinity of swamp harebell include the use and maintenance of roads and landings.

12.3.9.4.4 Mitigation that offsets the effects of forest management

Swamp harebell belongs to MC3 and receives a core occurrence area buffer with a 50-ft radius. Conservation measures include clearly marking the boundary of the core occurrence area and felling trees away from it when possible. Additionally, activities causing take will be restricted to the period between seed set and the breaking of dormancy, if feasible. Limited activities are permitted within both the core occurrence area and the buffer, including use of existing roads, landings, and rock pits.

12.3.9.4.5 Level of expected take

Conservation measures for swamp harebell are sufficient to protect most individual plants from take. However, take of 1.68 ac of swamp harebell may occur from use and maintenance of roads and landings, with very minor take from tree felling and yarding operations (Table 12-30).

12.3.9.5 Oregon goldthread (*Coptis laciniata*)

12.3.9.5.1 Location and distribution in the plan area

Seven occurrences of Oregon goldthread have been documented within the plan area, located in the following inventory blocks: Rockport, Albion, South Coast, and Big River. The number of individuals for the occurrences ranges from 25-65, and all were reported growing on stream banks. In addition to growing on stream banks, this species can typically be found in other mesic sites including meadows and seeps in coniferous forests.

12.3.9.5.2 Current condition of occupied habitat

A site description for the occurrences is currently not available.

12.3.9.5.3 Forest management adjacent to occupied habitat

The forest matrix surrounding Oregon goldthread occurrences is predominantly redwood/Douglas fir forest. Oregon goldthread occurs primarily in riparian areas. The main silvicultural prescription in the adjacent forests is high retention selection with entry into the stands once every 20 years beginning in the fourth decade of our HCP/NCCP.

12.3.9.5.4 Mitigation that offsets the effects of forest management

Oregon goldthread belongs to MC2 and receives a core occurrence area buffer with a 50-ft radius. Conservation measures include clearly marking the boundary of the core occurrence area and felling trees away from it when possible. When feasible, activities will be restricted to the period between seed set and the breaking of dormancy. Spoils from road maintenance will not be transported more than 100 ft from their plant population unless other requirements take precedence. Limited activities are permitted within the periphery of the core occurrence area and the buffer, including use of existing roads, landings, and rock pits.

12.3.9.5.5 Level of expected take

Conservation measures for Oregon goldthread are sufficient to protect individual plants from take. MRC does not expect take for existing occurrences. However, since we have only surveyed 10% of the plan area, minor take (.25 ac) may occur from timber harvest as well as road and landing use during the term of our HCP/NCCP in areas still un-surveyed for Oregon goldthread.

12.3.9.6 Pygmy Cypress (*Hesperocyparis pygmaea*)

12.3.9.6.1 Location and distribution in the plan area

All 4 occurrences of pygmy cypress in the plan area were located in the Albion inventory block. Three of the occurrences were in the pygmy forest, where covered activities will rarely take place. The fourth occurrence comprised 300 individuals and was located in pygmy transitional forest along roads, landings, and skid trails.

12.3.9.6.2 Current condition of occupied habitat

A site description for the occurrences is currently not available.

12.3.9.6.3 Forest management adjacent to occupied habitat

Forest management activities are not expected to affect the occurrences located in pygmy forest. The occurrence located in pygmy transitional forest is expected to experience impact from project activities. The dominant species in this transitional forest is redwood. The stand is scheduled for rotational harvest every 20 years with the first prescription calling for rehabilitation harvest and subsequent selection harvest. Additional harvest-related activities that will occur in the vicinity of pygmy cypress include the use and maintenance of roads and landings.

12.3.9.6.4 Mitigation that offsets the effects of forest management

Pygmy cypress belongs to MC4 and receives the lowest level of protection from conservation measures. The boundary of the core occurrence area will be clearly marked and impacts to individual plants will be avoided to the degree necessary to meet conservation objectives.

12.3.9.6.5 Level of expected take

Conservation measures outlined for pygmy cypress are sufficient for protecting individual trees from take during activities associated with felling trees. However, 0.76 ac of take for pygmy cypress is expected to occur from activities associated with using and maintaining roads and landings (Table 12-30). This expectation likely underestimates the amount of take that could occur from project activities during the life of the plan. The occurrence that will be affected by project activities comprises 300 trees, which undoubtedly occupy more area than the core area assigned to it.

12.3.9.7 Coast Lily (*Lilium maritimum*)

12.3.9.7.1 Location and distribution in the plan area

Four occurrences of coast lily were reported from the South Coast and Garcia inventory blocks. All occurrences reported low numbers of individuals, ranging from 1-10 plants. Several of the occurrences documented plants growing alongside roads. This species typically occurs in mesic sites in a variety of habitat types within 1-2 miles from the coast.

12.3.9.7.2 Current condition of occupied habitat

The 2008 Mendocino Lightning Complex fires burned 2 of the 4 occurrences. Both occurrences were in the Lower Alder Creek watershed in the South Coast inventory block. The impact of the fire on the plants is currently unknown.

12.3.9.7.3 Forest management adjacent to occupied habitat

The forest matrix surrounding coast lily occurrences is redwood/Douglas fir forest. The harvest prescription for the stands is selection harvest on a 20-year rotation cycle. Additional harvest-related activities that will occur in the vicinity of coast lily include the use and maintenance of roads.

12.3.9.7.4 Mitigation that offsets the effects of forest management

Coast lily belongs to MC1 and receives a core occurrence area buffer with a 150-ft radius. All harvest-related activities are excluded from the core occurrence area. Limited activities are permitted within the buffer, including use of existing roads, landings, and rock pits.

12.3.9.7.5 Level of expected take

Conservation measures outlined for coast lily are sufficient for protecting individual plants from take during activities associated with felling trees. However, 0.59 ac of take for coast lily is expected to occur from activities associated with using and maintaining roads (Table 12-30). This estimate of take likely over estimates the amount of take that will occur at these sites. The numbers of individuals per occurrence for coast lily were $\leq$10 plants and those plants probably occupy an area much smaller than the core area assigned to them for the analysis.

12.3.9.8 North Coast Semaphore Grass (*Pleuropogon hooverianus*)

12.3.9.8.1 Location and distribution in the plan area

Seven occurrences of North Coast semaphore grass have been documented in the plan area, all within the Upper Ackerman Creek watershed in the Ukiah inventory block. Two of the occurrences had 10 or fewer individuals, 1 occurrence had 200 individuals, and the remaining 4 occurrences had numbers ranging from 1,500 to >10,000 individuals. Plants were documented growing along roadsides, in mesic grasslands and seeps, and near streams. This species is typically associated with broadleaved upland forests and North coast coniferous forests.

12.3.9.8.2 Current condition of occupied habitat

A site description for the occurrences is currently not available.

12.3.9.8.3 Forest management adjacent to occupied habitat

The forest matrix surrounding North Coast semaphore grass occurrences is Douglas fir forest and conifer hardwood forest. The predominant harvest prescription in these stands is selection harvest scheduled on a 20-year rotation cycle. A number of stands don't receive their first harvest until Year 60 of the plan. Additional harvest-related activities that will occur in the vicinity of North Coast semaphore grass include the use and maintenance of roads and landings.

12.3.9.8.4 Mitigation that offsets the effects of forest management

North Coast semaphore grass belongs to MC1 and receives a core occurrence area buffer with a 150-ft radius. All harvest-related activities are excluded from the core occurrence area. Limited activities are permitted within the buffer, including use of existing roads, landings, and rock pits.

12.3.9.8.5 Level of expected take

Conservation measures outlined for North Coast semaphore grass are sufficient for protecting individual plants from take during activities associated with felling trees. However, 2.77 ac of take for North Coast semaphore grass is expected to occur from activities associated with using and maintaining roads and landings (Table 12-30).

12.3.9.9 Bolander's Beach Pine (*Pinus contorta* ssp. *bolanderi*)

12.3.9.9.1 Location and distribution in the plan area

All 4 occurrences of Bolander's beach pine were located in pygmy forest in the Albion inventory block. Numbers of individuals for these occurrences were low; reports documented several individuals at each location.

Bolander's beach pine is one of the few covered species for which we understand the key habitat requirements and can predict suitable habitat with a certain degree of accuracy. This species is restricted to the acidic, shallow soils within closed-cone pygmy forests at elevations from 225-750 ft. The plan area consists of 719 ac (0.3%) of potentially suitable habitat for Bolander's beach pine.

12.3.9.9.2 Current condition of occupied habitat

A site description for the occurrences is currently not available.

12.3.9.9.3 Forest management adjacent to occupied habitat

All occurrences of Bolander's beach pine occur in pygmy forest. No project activities are scheduled in the vicinity of any known occurrence during the permit term.

12.3.9.9.4 Mitigation that offsets the effects of forest management

Bolander's beach pine belongs to MC4 and receives the lowest level of protection from conservation measures. The boundary of the core occurrence area will be clearly marked and impacts to individual plants will be avoided to the degree necessary to meet conservation objectives.

12.3.9.9.5 Level of expected take

MRC has not scheduled PTHPs near any known occurrence of Bolander's beach pine. However, there is currently light road use near known populations and there will be future road use in areas still un-surveyed for Bolander's beach pine. As a result, .1 ac of take may occur for this species.

12.3.9.10 White-Flowered Rein Orchid *(Piperia candida)*

12.3.9.10.1 Location and distribution in the plan area

Two occurrences of white-flowered rein orchid have been documented in the plan area—1 in the Garcia inventory block and 1 in the Rockport inventory block. Both occurrences reported low numbers of individuals. This species prefers open-to-shaded sites within broadleaved upland forests, lower mountain coniferous forests, and North Coast coniferous forests.

12.3.9.10.2 Current condition of occupied habitat

A site description for the occurrences is currently not available.

12.3.9.10.3 Forest management adjacent to occupied habitat

The forest matrix surrounding white-flowered rein orchid occurrences is conifer hardwood forest. The harvest prescription in these stands is selection harvest scheduled on a 20-year rotation cycle with the first entry into the stands occurring in Year 60 of the permit term. Additional harvest-related activities that will occur in the vicinity of white-flowered rein orchid include the use and maintenance of roads.

12.3.9.10.4 Mitigation that offsets the effects of forest management

White-flowered rein orchid belongs to MC2 and receives a core occurrence area buffer with a 50-ft radius. Conservation measures include clearly marking the boundary of the core occurrence area and felling trees away from it when possible. When feasible, activities will be restricted to the period between seed set and the breaking of dormancy. Spoils from road maintenance will not be transported more than 100 ft from their plant population unless other requirements take precedence. Limited activities are permitted within the periphery of the core occurrence area and the buffer, including use of existing roads, landings, and rock pits.

12.3.9.10.5 Level of expected take

Conservation measures outlined for white-flowered rein orchid are sufficient for protecting individual plants from take during activities associated with felling trees. However, 0.07 ac of take for white-flowered rein orchid is expected to occur from activities associated with using and maintaining roads (Table 12-30).

12.3.9.11 Maple-Leaved checkerbloom *(Sidalcea malachroides)*

12.3.9.11.1 Location and distribution in the plan area

Maple-leaved checkerbloom is known from 6 occurrences in the plan area, all within a relatively short distance from the coast. It occurs in the following inventory blocks: Rockport, Albion, Navarro West, and South Coast. Numbers of individuals range from 1-80. This species prefers disturbed areas within broadleaved upland forest, coastal prairie, coastal scrub, and North Coast coniferous forests. All documented occurrences were reported along roadsides and landings.

12.3.9.11.2 Current condition of occupied habitat

The 2008 Mendocino Lightning Complex fires burned through the Juan Creek watershed in the Rockport inventory block. One occurrence of maple-leaved checkerbloom with 70 individuals was documented along the roadside in this drainage in 2007. Fire suppression activities including road grading and widening occurred in the vicinity of this occurrence. Surveys are needed to determine the extent of the impact. This is a perennial species and the majority of the individuals are thought to have been destroyed by road grading. However, the occurrence may persist since it is a disturbance-oriented species capable of regenerating from remnant seeds in the soil.

12.3.9.11.3 Forest management adjacent to occupied habitat

The forest matrix surrounding maple-leaved checkerbloom occurrences include redwood/Douglas fir forest, conifer hardwood forest, and mixed hardwood forest. The initial harvest prescription for most of the stands is transition or variable retention harvest. Harvest rotation is on a 20-year cycle with subsequent prescription calling for selection harvest. Additional harvest related activities that will occur in the vicinity of maple-leaved checkerbloom include the use and maintenance of roads.

12.3.9.11.4 Mitigation that offsets the effects of forest management

Maple-leaved checkerbloom belongs to MC4 and receives the lowest level of protection from conservation measures. The boundary of the core occurrence area will be clearly marked and impacts to individual plants will be avoided to the degree necessary to meet conservation objectives.

12.3.9.11.5 Level of expected take

Conservation measures outlined for maple-leaved checkerbloom are sufficient for protecting individual plants from take during activities associated with felling trees. However, 1.4 ac of take for maple-leaved checkerbloom is expected to occur from activities associated with using and maintaining roads (Table 12-30).

12.3.9.12 Long-Beard Lichen *(Usnea longissima)*

12.3.9.12.1 Location and distribution in the plan area

Long-beard lichen is found in all inventory blocks except the Noyo and Ukiah blocks. Sixteen occurrences have been reported with numbers of host trees ranging from several to 50. The majority of the occurrences are along ridge tops and reported host trees include Douglas fir, redwood, and madrone. Long-beard lichen is typically associated with North Coast coniferous forests and broadleaved upland forests up to 2000 ft in elevation

12.3.9.12.2 Current condition of occupied habitat

A site description for the occurrences is currently not available.

12.3.9.12.3 Forest management adjacent to occupied habitat

The forest matrix surrounding long-beard lichen occurrences is redwood/Douglas fir forest. The harvest prescription for these stands is selection harvest on a 20-year rotation schedule. Additional harvest related activities that will occur in the vicinity of long-beard lichen include the use and maintenance of roads and landings.

12.3.9.12.4 Mitigation that offsets the effects of forest management

MRC proposes species-specific conservation measures for long-beard lichen (C§11.8.1-1 to C§11.8.1-8), including protecting up to 10 source trees in any PTHP area (C§11.8.1-3). Additionally, old growth trees and snags will be protected as habitat for long-beard lichen colonization (C§11.8.1-6).

12.3.9.12.5 Level of expected take

Conservation measures for long-beard lichen are sufficient to protect up to 10 individual source trees per PTHP. If more than 10 source trees exist in a PTHP area, MRC may fell source trees. As a result, 1.68 ac of take may occur for this species from tree felling, yarding, and use and maintenance of roads during the term of our HCP/NCCP (Table 12-30).